Sab Notes

Dec. 29, 1891 –
June 5, 1893

Beinn Bhreagh

Laboratory Notes

Return to Alexander Graham Bell
Beinn Bhreagh near Baddeck.
Cape Breton Island
Nova Scotia

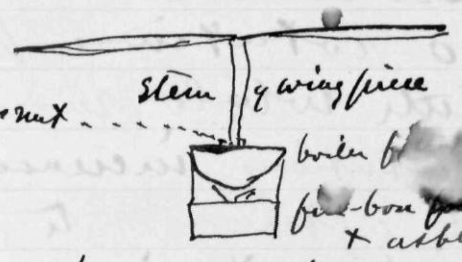
Beinn Bhreagh Notes
Continued from p. 256 of other
Note book of this date.
Dec. 29th. 1891 AGB

1891 Dec. 29th. Tuesday — at Beinn Bhreagh

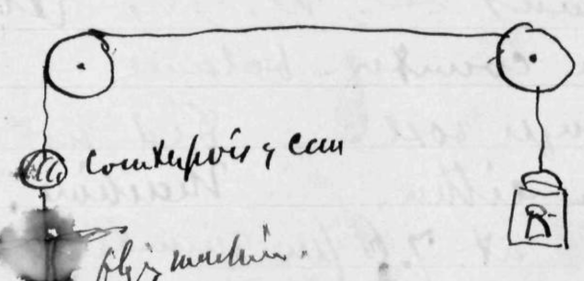
Exp. 1. Will now try flying-machine apparatus with alcohol in boiler — burning the jet of alcohol as W. Ellis suggested — This will avoid filling laboratory with dangerous gas — Consumed as it comes out.

(weighed)	Weight of alcohol in boiler	= 200 grammes.
(calculated)	Weight of alcohol in fire box	= 299 grammes.
(addition of weights)	Weight of ~~apparatus~~ apparatus	= 429 grammes
(calculated)	Total weight of charged apparatus	= 928 grammes.
(weighed)	" " " " "	= 923 grammes

Difference — = 5 grammes less than calculated.



Will set fire-hose ready in case of accident. Apparatus now balanced as before — in yesterday's experiment.



Alcohol lighted at 4.35 p.m.

(Over)

1891 Dec. 29th — Tuesday — at Wbh.

Expl cont.

When vapour was just projected from nozzle & wing-pulley W. Ellis applies lighted match. Steam lights — but considerable portion of vapour was on fire also — evidently some lights projected alcohol spray and not vapour.

Blew out flame and worked until there was quite pressure, and gas came without alcohol. Lighted match applied — blown out — caused vast light jet. Opened windows to allow circulation of air through the room — and turned on water on to the fire-hose — Kept stream playing out of window — ready for any emergency. In five minutes wings were revolving making 60 rotations per minute. In a little while more (one or two minutes) rotations increased to 68 per minute and shortly afterwards to 76 per minute when thing began to rise. Kept up a regular rotation of 76 per minute afterwards — W. Ellis removed 5 ozs from the counter-balance — and the machine no longer rose — Did not fall however either. Machine continued rotating at 76 per minute till 4.50 p.m. when soldering of top & boiler gave way at one point leading to escape of vapour which took fire. Mr Ellis easily smothered flame of asbestos wick — with

1891 Dec 24 — Tuesday — 10 p.m.

Expt. contd.

a sheet of brass — and blew out flame from ~~weak~~ leak. No necessity for fire-hose.

Apparatus now cool enough to be weighed.

Weight of whole apparatus before experiment = 923 grams
" " " " after " = 728 "
Alcohol consumed and evap. = 195 grms

Weight of fire-box before exp. = 489 as p. 256 other book
" " " after " = 447
(Fuel consumed) Alcohol burned = 42 grammes

Total alcohol lost = 195 grms
" burned = 42
" evaporated = 153 grms.

Alcohol left in fire-box.

Weight of fire-box after experiment = 447 grms
" " " alone = 197 grms as p. 256 other box
Alcohol still in fire-box = 250 grms.

Alcohol left in boiler.

~~Weight of wing-pins swivel joint brass nut from boiler & three suspension wires~~ } = 140 p. 256 other vol.
Weight of empty
Weight of alcohol in boiler before exp. = 200 grms (p. 1)
Alcohol evaporated — = 153 grms (as above)
Total alcohol now in boiler = 47 grms.

Pressure were not great — not sufficient to bolge up — top of boiler.

Over

1891 Dec. 29th. Tuesday — at B.B.

The internal diameter of nozzles of wings = 0.04 inch

E.K.G.

N.B. Will now try enlarging them to 0.08 inch — and note whether this will give increase of speed.

Expect that enlargement of nozzle will give greater quantity of out-rush — at less velocity — and reducing orifice greater velocity of out-rush with less quantity. Query — which will produce greater rotation of apparatus.

Mr. Ellis says it will be easier to enlarge the nozzles than to make them smaller. Proposes to enlarge first — and then if advisable plug up with new nozzles finer diam.

Hardly worth while trying ~~the~~ larger hole — Our experiments have evidently suffered from too little pressure — and enlarging nozzles will still further reduce pressure. Will try smaller nozzles first. Mr. Ellis will now make new nozzles and drill hole with smallest drill we have. Diam = 0.025

While Mr. Ellis is at work will note graphoph. experiments made this morning.

E.K.G.

Exp. 2. Four records ~~made~~ upon graph. cylinders were taken and covered with plaster. The moulds are numbered 1, 2, 3 & 4. In all cases the plaster ~~was composed~~ mixture was composed of plaster of paris 60 p.c. — water 40 p.c. and the water had temperature of 80° F.

For results see p. 25.

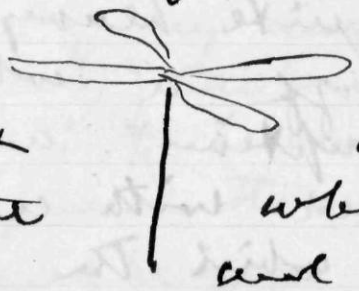
Mould No. 1 not brushed — poured in — not stirred
" No. 2 not brushed — poured in — stirred
" No. 3 brushed — poured in — not stirred
No. 4 brushed — poured in — stirred.

Cylinders have not loosened yet — Will wait a day or two before noting results to let plaster dry.

1891 Dec. 29 — Tuesday — at BBL.

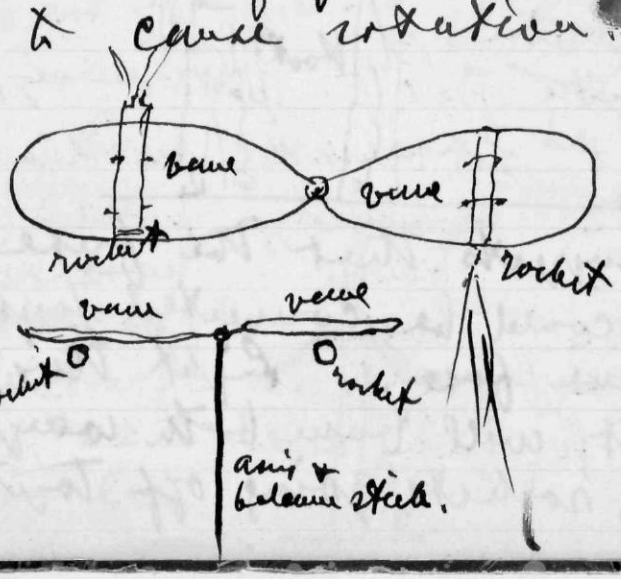
While Mr Ellis is at work making nozzles will note some ideas I neglected to note yesterday.

Model a new species of fire-works — Attach fire-works to flying machine. Flying fire-works. Take for example ordinary wheel fire-work  that is stuck on a board with a pin — to or horizontal axis — and spins round making a fabulous effect. Attach this to propeller flying-machine like French toy —

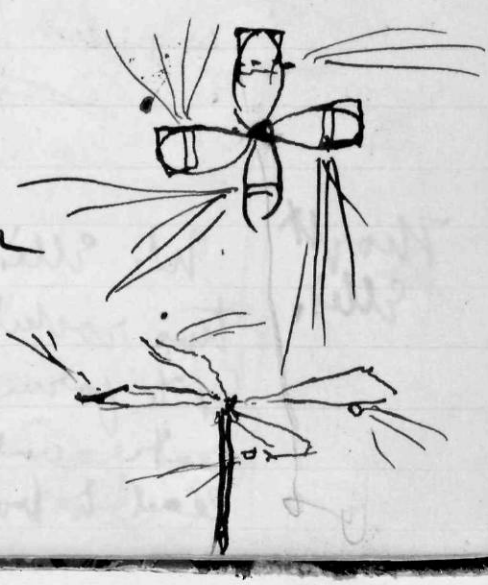


so that and the so as — axis is vertical whole thing should and you would have effect of wheel of fire in sky.

I imagine a very fine effect would be produced by attaching powerful rockets — horizontally (or nearly so) under the vanes of fan-wheel arrangement so as to cause rotation.



or

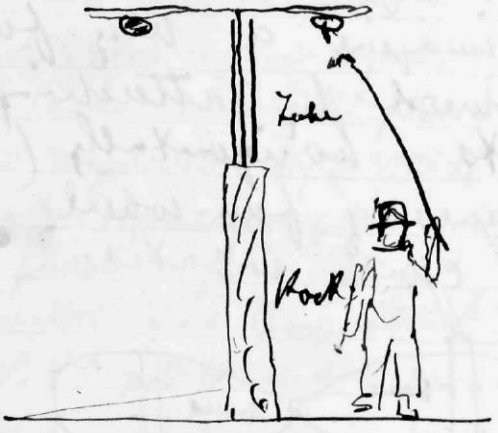


1891 Dec. 29th — Tuesday — at Bible.

Such an arrangement would screw itself up into sky with great velocity — and produce quite a novel effect — a tremendous wheel of fire. Apparatus could be made to carry up other fireworks timed to go off when apparatus is high up in the air. Set pieces could be arranged of course extremely novel description.

Sticks or axes would probably come gently down if the ~~fans~~ wing-pieces are unbroken — even though they might be quite heavy.

To set off a whirling rocket of this description a long pole or post might be used with a tube at the end into which the stick or axis of the whirling rocket could be placed.

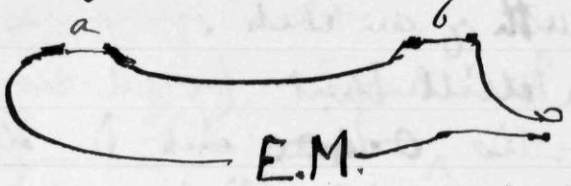


Weight Ellis.

Mr. Ellis suggests that the fuse for the two rockets could be connected together so as to form one fuse. Light this in the centre and it will burn both ways and lead to both rockets going off together.

Another way to secure same effect would be to set them off electrically — by an electric fuse.

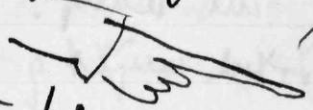
EM = Electro-motive force.



When circuit is completed by depression of Key K or otherwise — let (a) and (b) become red hot. If (a) & (b) are used as fuses for the two rockets — both rockets should start movement Key is depressed. (a) & (b) could be composed of fine wire of any description (eg iron or platinum (expensive)) Carbon — or any material so arranged as to become red hot when current is passed through it.

(a) & (b) could be gaps in circuit — and electric sparks be caused there — but don't think this would explode powder — might inflame tinder or something that Kind & then indirectly cause the explosion.

To set off small "flying fire-works" — or "whirling rockets".



When larger ones are to be set off a shelter could be made for operator & mercury or advisable,

1871 Dec. 29 — Tuesday — at Ellis.

Exp. 3. Ready for Experiment 3. W. Ellis says he can measure diam. of drills employed in boring nozzle holes to a fraction of one Thousandth of an inch.

The drill that bored nozzles used in Exp. 1 — is 0.0400 inch in diameter.

S/0.0400

New nozzles have now been made & drill employed measures 0.0235 inch in diam.

W. Ellis is pouring 200 grammes of alcohol into boiler.

N.B. We feel that too little pressure has been obtained yet to give apparatus fair play. Hole not small enough if no hiss is produced. Pressure so far has not been sufficient for this.

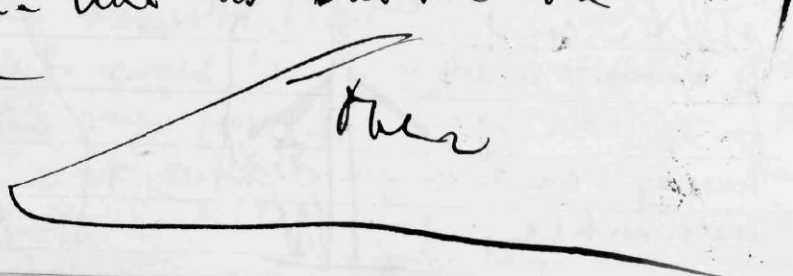
Will not put any more alcohol into fire-box — as there seems to be enough left for good experiment.

Getting fire-hose ready again. Mr Ellis soldering stem on to boiler — and soldering up leak.

All ready.

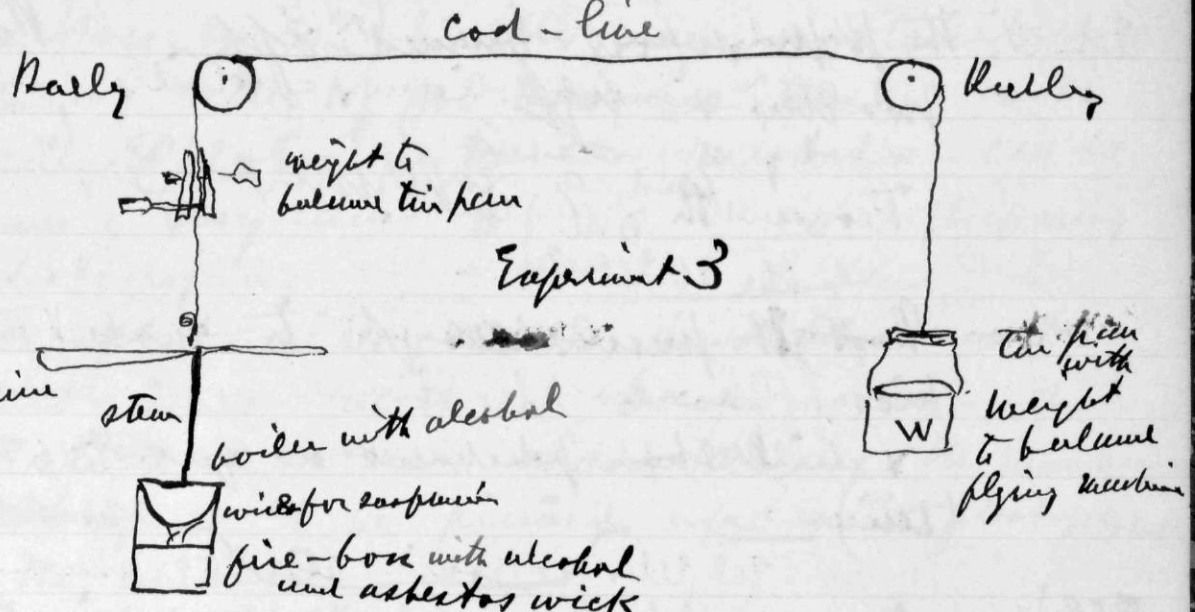
Total weight of apparatus before Exp. 3 = 9 lb 7

Whole thing now balanced & suspended by cord-line as shown on next page —



1891 Dec. 29 — Tuesday at 9.56

Exp. 3



~~Flying machine~~

Wick lighted at 9.45 p.m. Windows opened for circulation. 9.46 p.m.

at 9.50 p.m. rotations 88 per minute

at 9.53 p.m. " 92 per minute.

Flame not satisfactory. Put flame out and re-filled fire-box — using asbestos so as to make a fierce flame.

Flame re-lighted at 9.54.

~~at~~ At 9.59 — first hiss heard but solder on top of boiler melted. Big flame for a moment — then burned quietly.

Burning alcohol spattered over workshop but went out without damage. Fire-hose not called into requisition.

Smothered flame from fire-box — and succeeded in blowing out flame from boiler. Unnecessary to use water although fire-department all ready!

Flame not yet obtained sufficient pressure to test capabilities of apparatus. Out of

1891 Dec - 29th - Tuesday at 4 P.M.

the paper wings burned off. Present
Mr. Ellis & Agt.

End of Experiment - 3!

Must get pressure enough to make the thing hiss.

We have purchased a quart milk-pan (tin) ___ ⌣ to solder about it

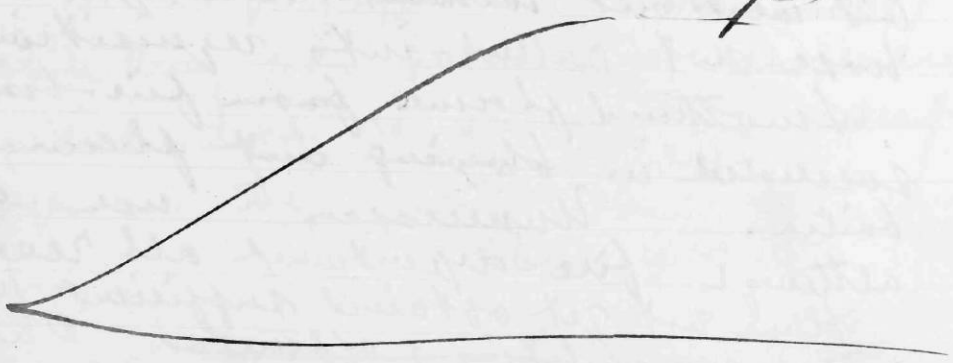
Ellis Agt Cover with brass plate and rivet it to edge pan - and then solder together. Blacken bottom of pan.

Ellis Agt. Cover soldered edge with asbestos to prevent flame playing on solder.

Ellis Agt Cover the whole of boiler excepting bottom with asbestos - this will not only prevent flame from playing directly on soldered edge - but will also prevent loss of heat by radiation from boiler. Asbestos I believe - is a non-conductor of heat.

Noted at Berlin Ont. C.B.
Dec 29th 1891

Agt



1891 Dec. 31st. Thursday – at B.B.L.

Yesterday (Wed. Dec. 30th.) W. Ellis made a stencil-plate for printing letter M for Merino – Used with other stencil plates we have – printed on cards the names & Barry rams [NN 34–91] &c. Preparing for photographing. Intend to photograph all my rams and the most important Ewes with a background of dark cloth or calico. Card bearing the number & the sheep will be pinned up and photographed with the animal.

Rest of time yesterday devoted to new boiler for flying-machine.

Exp-1. Today (Thursday Dec. 31) – filled little bottles with specimens of all the different kinds of oils we can obtain to test effect upon ozokerite. A little fragment of ozok. has been placed in each bottle. Bottles are numbered 1 to 7.

Bottle No. 1 contains ozokerite in Turpentine.
– – 2 " " " " " linseed-oil.
– – 3 " " " " " porpoise-oil.
– – 4 " " " " " olive-oil
– – 5 " " " " " Castor-oil
– – 6 " " " " " sperm-oil
– 7 " " " " Ether

Most marked effect produced by olive-oil. Oil has become somewhat the color of beer — pretty dark — reddish shade. Turpentine & ether also seem to affect ozokerite.

No effect sufficiently marked to be perceptible as yet produced by Linseed oil, porpoise oil, sperm oil, or castor-oil. Ozok. floats in castor-oil.

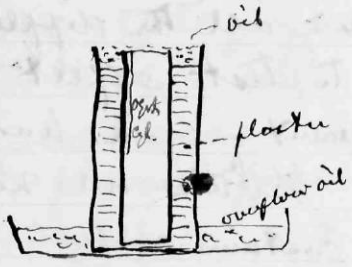
over

1891 Dec. 31 — Thursday — at Bdde.

Mr. Ellis almost finished new boiler for flying-machine

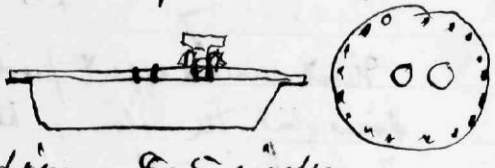
Dry oiling cyde. cylinder before taking moulds — with linseed oil, porpoise oil, castor oil, & sperm-oil.

Mix liquid plaster in vessel A — stirring should expel air. Pour in oil (say linseed) on top of plaster and see that no air bubbles in it. Now take cyde. cyl. closed at bottom — oil it (say with linseed). Immerse it in oil above plaster — and brush it while it is in the oil to expel any air bubbles in record groove. push it down into plaster. Plaster should rise round cyde. cylinder — and oil overflow into dish below.



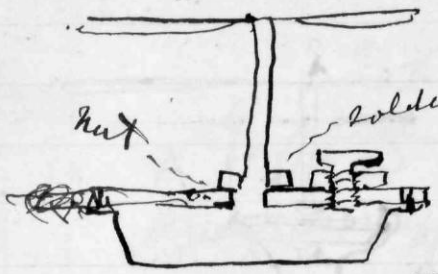
Jan. 2. 10.30 p.m. Just returned from Baddeley — meeting of the Ladies Society of Baddeley. Mr. Ellis finishes new boiler this afternoon.

Boiler consists of giant milk pan — of tin without solder — brass plate riveted on top and soldered also.



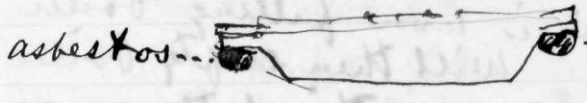
Thickness of brass plate = 0.06 inch. diam. 8.5 inches
Number of rivets in circ. = 55 depth external 2 inches.
Soldered round edge as well as riveted.
Weight 432 grammes. Two holes in brass plate — one for attachment of stem of wing piece — other for purpose

of filling boiler. Filling hole fitted with screw — with large head — & washer under the head.



The nut & the stem of wing piece only attached to brass plate by solder. That is our weak point. Tomorrow intend to run three screws through the brass nut into the plate below so that attachment will not depend entirely upon strength of solder.

To protect solder & edge from direct action & flame a rope of asbestos will be wound



round boiler under edge.

Same wing-piece used as in Tuesday's experiment 3 (p. 8-9).

N.B. (about Exp. 2, p. 4) Plaster mould No. 3 (Exp. 2 p. 4) removed this morning. It was loose yesterday and was moved today. Another mould was loose yesterday — (W. Ellis says No 4 seems quite loose now — but must come out without scraping our end — My loose though.

No 1 & 2 were tight yesterday. Now No. 1 is loose but sticks a little. Left in. No. 2 still tight.

Exp. 2 cont. The burned paper wings were replaced this morning by a new wing — made of brown wrapping paper as before.

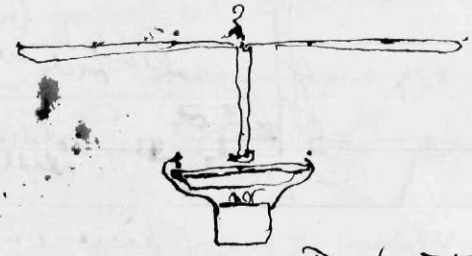
Over

1871 Dec. 31 — Thursday — at B'Ble.

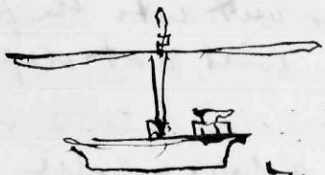
Exp 3 cont.

Exp 2 cont.

Same fire-box used in former experiments will be employed — but new suspension wires will be employed.



Mr. Ellis is now smoking the bottom of the boiler with lamp-black produced by burning camphor underneath.



Weight of empty boiler with wire-pin attached and screw for filling-hole = 5'84 grammes.

Mr. Ellis is now filling boiler with warm water — will then empty boiler out — and take about one third the quantity and put inside for experiment.

Warm water required to fill boiler weighs 1208 grs. Water poured out and 395 grammes of water put in.

Three turns of asbestos rope wound round boiler under soldered & riveted edge and tied on top

Asbestos wrapping.

Apparatus all ready. Total weight of whole concern filled & ready for Experiment — boiler fire-box water alcohol & all = 1612 grammes.

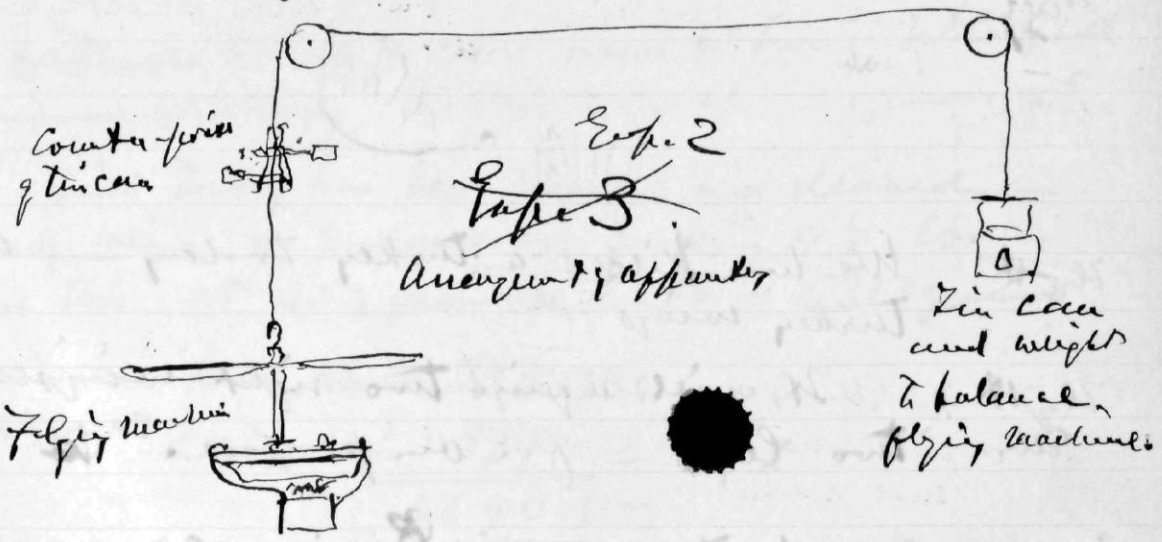
Over

1891 Dec. 31 — Thursday — at Bibb-

all ready for trial.

Exp. 3 cont.

Exp. 2 cont.



Fire lighted at 11.36 p.m. Start 11.38 p.m.

116 rot. per min	11.40 p.m.
128	11.41 p.m.
128 rot.	11.43 p.m.
136 rot.	11.45 p.m.
136 rot.	11.46 p.m.

Light put out at 11.46 p.m.

Apparatus rose slightly — Lowered counter-balance.

Whole apparatus after exper. weighs = 1432 grams

Boiler &c with residual water	=	888 grs
Fire-box with wires & residual alcohol	=	539 grs
		1427
Asbestos rope	=	12 grs
The three suspension wires	=	10 grams

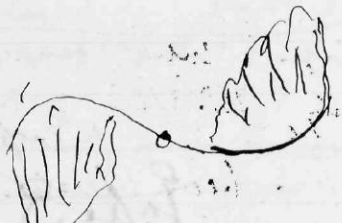
Whole apparatus re-weighed = 1425 grs.

(Early exp. 2.)

Orv

1871 Dec. 31 — Thursday — at Wilks

Use bird's wings on apparatus.



We have killed a turkey today — use turkey wings.

It will require two right wings — or two left — for our purpose —

N.B. One of the turkey's wings weighs 188 grammes.
Left wing weighs 188 grammes
Right wing weighs 189 grammes (Nov. wing & cut)

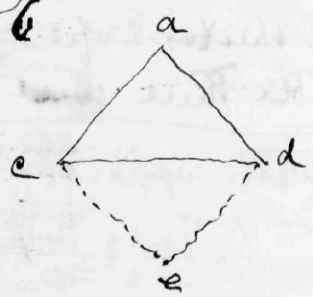
Left wing

ab = 18 inches
ac = 17
ad = 17½ inches
cd = 21½ inches

Angle at a = 180°.

Area triangle acd = ½ area of parallelogram acbd

Area acbd = 18 × 18 (nearly)
= 162 square inches.



Will weigh bird at house to see what weight

should be supported by such wings.

N.B. when I Exp. 3 / Exp. 2

Witnesses to Exp. 2 were Messrs McInnis, Mr. Campbell (surveyor), Mr. McCurdy, Mr. Ellis, & myself — 5 persons.

Tried Turkey has been plucked and cleaned — Body weighs as prepared for cooking 9½ lbs — and this at 454 grammes per lb = 4313 grammes

Body = 4313 grs
2 wings = 377
4690 grs

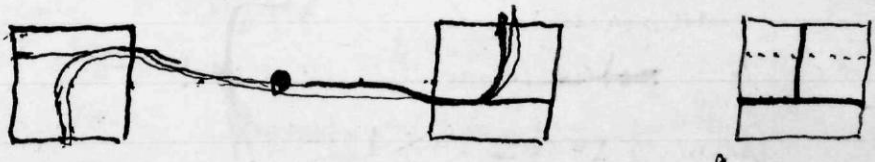
Mr. McInnis says that entrails &c — feet & lower legs and head — and feathers should weigh 2½ lbs. — or 1135 grammes

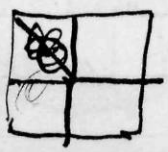
4690
1135
Total Turkey 5825 grammes

Our whole apparatus as used in Exp. 3. weighed only 1612 grammes (see p. 14).

Result: Quite a slow rotation of flying machine with wings & dimensions of Turkeys wings — should fly.

Let each wing have one square foot of surface. Should be amply sufficient.





Total Dec. 31st/91
at Beinn Bhreagh
by Alexander Graham Bell

1891 Dec. 31st — Thursday — at B.Bh.

136 rots. per minute
90
12 | 12240 inches per minute
60 | 1020 feet per minute
17 feet per second.

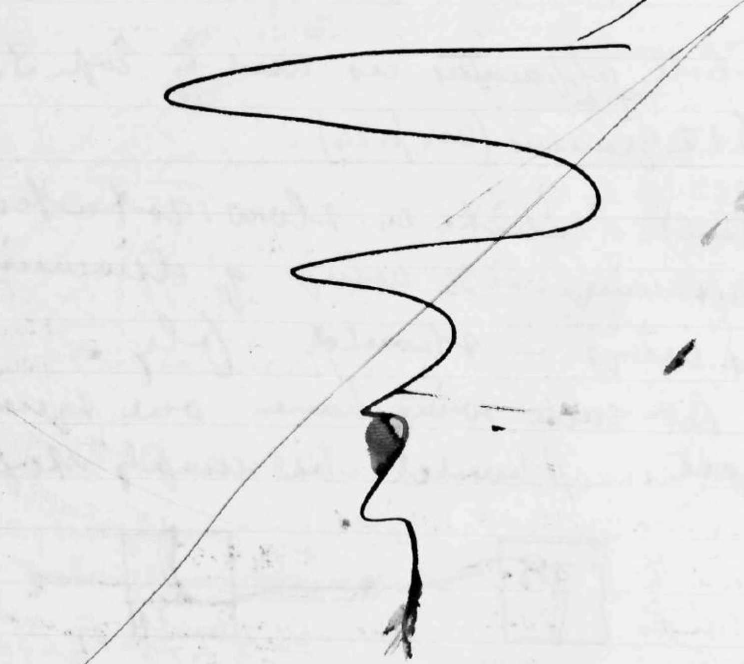
30
3
90

Promising. Given larger wing area and perhaps this rotation would lift it. Give at least one square foot of wing surface to each wing.

Also worth while trying still smaller nozzle — and larger ~~flame~~ fire — to make steam more quickly.

Noted Dec. 31st. Thursday

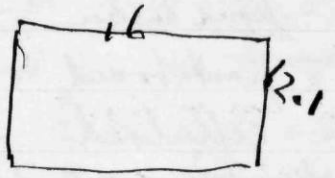
AGB



1892 June. 1st — Friday — at Bibb —

Steel

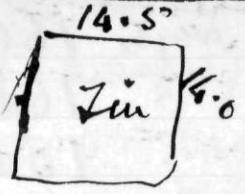
a steel plate 0.013 inch thick — width 12.1 inches
Length 16 inches. Rectangular parallelogram.



12.1
16
726
121
193.6 square inches

This weighs 310 grammes.

Tin-plate

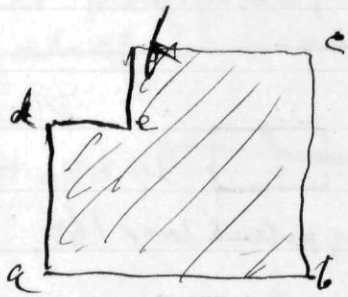


Length 14.5"
breadth 14.0
thickness 0.011

14.5"
14
580
145
203.0 sq. inch.

Weight 332 grammes

Heavy rubber



ab = 16 inches
bc = 16.5 inches
de = 2.3
ef = 3.6

Thickness = 0.05 inch

2.3
3.6
138
69
8.28

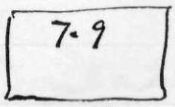
264
8.28
2112
1584
2188.92 sq. inches

16.5
16
990
165
264.0

Area = (ab × bc) − (de × ef) = 256 sq. inches.

Weight. 259 grammes

Paste board.



Card measures
length 7.9 inch
breadth 4.9 inch
Thickness 0.016 inch thick

White card-board used for sheep catalogue

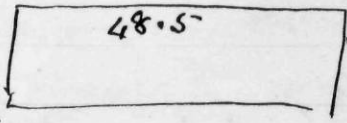
7.9
4.9
711
316
38.71 sq. inches

Area one card = 38.71 sq. inches
Area 10 cards = 387 sq. inches

Ten of these cards weigh 105 grammes

Celluloid.

Sheet of transparent celluloid rolled up in a roll & weighed.



Length 48.5"
breadth 20.2
thickness 0.01

48.5"
20.2
970
970
979.70 sq. inches.

area 979.70

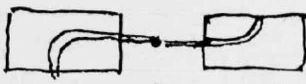
Weight = 227 grammes.

1892 Jan. 1 — Friday — at BBh.

194 sq. inches of thin sheet steel	weighs	310	grammes.
203 " " " " tinned iron	"	332	"
256 " " " " hard rubber	"	25.9	"
387 " " " " pasteboard	"	105	"
576 " " " " celluloid	"	224	"
162 " " of turkey's wing au naturel	"	188	"

Hence

100 sq. inch of thin sheet ~~steel~~ steel	weighs	160	grammes
100 " " " " tinned iron	"	164	"
100 " " " " hard-rubber	"	101	"
100 " " " " pasteboard	"	27	"
100 " " " " celluloid	"	39	"
100 " " " " turkey's wing à la nature	"	116	"

Tin wing  10 x 20 = 164 sq. inches

exactly area of turkey's wing which was 162.

~~Two tin wings~~

Empty boiler and wings as ~~used~~ already = 584 gms

Add two tin wings each 10 x 20 = 328

912

(See other vol. p. 250) Empty fire box with asbestos wick — 197

1109

Whole arrangement empty say 1135 grammes or 2½ lbs.

water (say) 454 gms or 1 lb.

alcohol (say) 454 gms or 1 lb.

~~Total~~ weight. 2043 gms or 4½ lbs.

Wings of similar area in a Turkey — carried a weight of 5825 gms or 12.8 lbs nearly 13 lbs.

1892 Jan 2d. Sat — at Bble.

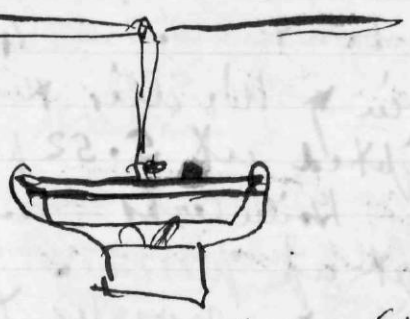
Elfd

Mr. Ellis has made two nozzles with drill 0.01 inch diam. He made the drill from a sewing needle.

We intend to try ~~steam~~ flying-machine (1) as used in Exp. 3 p. 15 — and then (2) with the new nozzles.

Exp. 1. Nozzles made with drill 0.0235 inch diam. (see p. 8. Exp 3). Whole arrangement as in Exp. 3 p. 15.

Orifice of nozzles = 0.0235 inch diam.
Weight of boiler, wing-pin & water = 135·5
Weight of pile-box asbestos with alcohol — and suspension wires = 49·6
Total. 185·1 grammes



Apparatus suspended as before (p. 15 Exp. 3) — Present — Mr. Martin, Mr. Ellis & A. G. B.

Fire lighted at 4·55 p.m.
Steam rotating at 4·56 p.m.

5·2 p.m. Rotat. per min. —— does not rotate well — not enough vis to overcome torsion of string. Rubber when water boiled down more rotation. Now rotating well 5·09 p.m.

5·10 p.m. ~~rotat~~ rotations per min. = 84

1892 Jan. 2 — Test — at Hyde.

Before Mr Ellis changes nozzles will re-weigh apparatus to ascertain loss.

Boiler & attachments = 1101 grms
Fire-box &c — = 457 "

Init. weight boiler &c	1355	Fire-box &c	496
Final " " " "	1101	" " "	457
Water consumed	254	Alcohol burned	39

Experiment concluded at 5.13 p.m.

Mr Ellis is now changing the nozzles so as to use smaller boiler.

Exp. 2. Nozzles 0.01 inch diam. hole.
Boiler &c — weighs 1355 grammes as in last exp.
Fire-box &c — " 496 " " " " "

Mr Martin & Mr Ellis & self present.
Fire lighted at 5.52 p.m.

Boiler leaks — and both nozzles leak — cannot get up pressure. Mr Ellis has Taken boiler & nozzles to re-solder.

Obtained pressure this time — as boiler plate has become somewhat covered above.

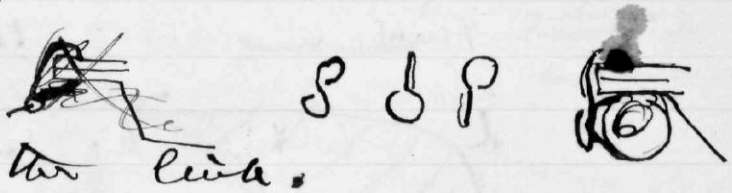
Water has started from solder in three places. Will re-solder wherever there and try again.

Mr Ellis thinks that perhaps the boiler has been started at the time of Exp. 3 p. 15 — and that this may account for poor vaporization when experiments were repeated (Exp. 1 p. 21).

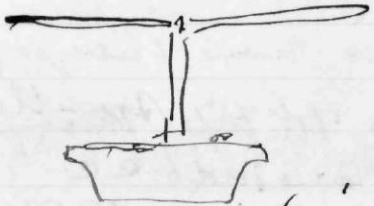
1892 Jan. 2 — Sat — at [illegible]

These dents are observable on bottom of boiler — as though it had been dropped — but don't remember any accident happening.

Expt 3 W. Ellis has now repaired leaks.
W. Ellis has attached lines to the boiler & attached suspension wires — and asbestos



rope wired to the lines.



Boiler & wire pins &c — (empty) = 648 grammes
(weighed Saturday — new brass lines & asbestos rope)

Before Expt. 1 Water = 454 gram (1 lb)

Boiler & water &c 1102 grammes
Fire-box, alcohol & suspension wires 514 grammes
Total — 1616

Nozzle — orifice 0.01 inch. diam

Whole arranged and balanced as per (Expt 3 p. 15)

Fire lighted 10.14 p.m.

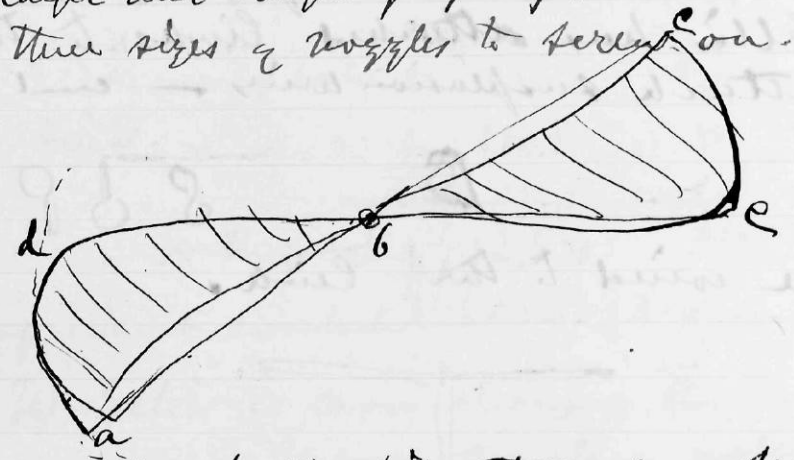
Pressure O.K. — pipes carrying nozzles split — or cracked so that there was a double jet of steam at either nozzle blowing both ways. Boiler became slightly covered both top and bottom — and steam escaped at a few places.

Result: Nozzle too small — and probably

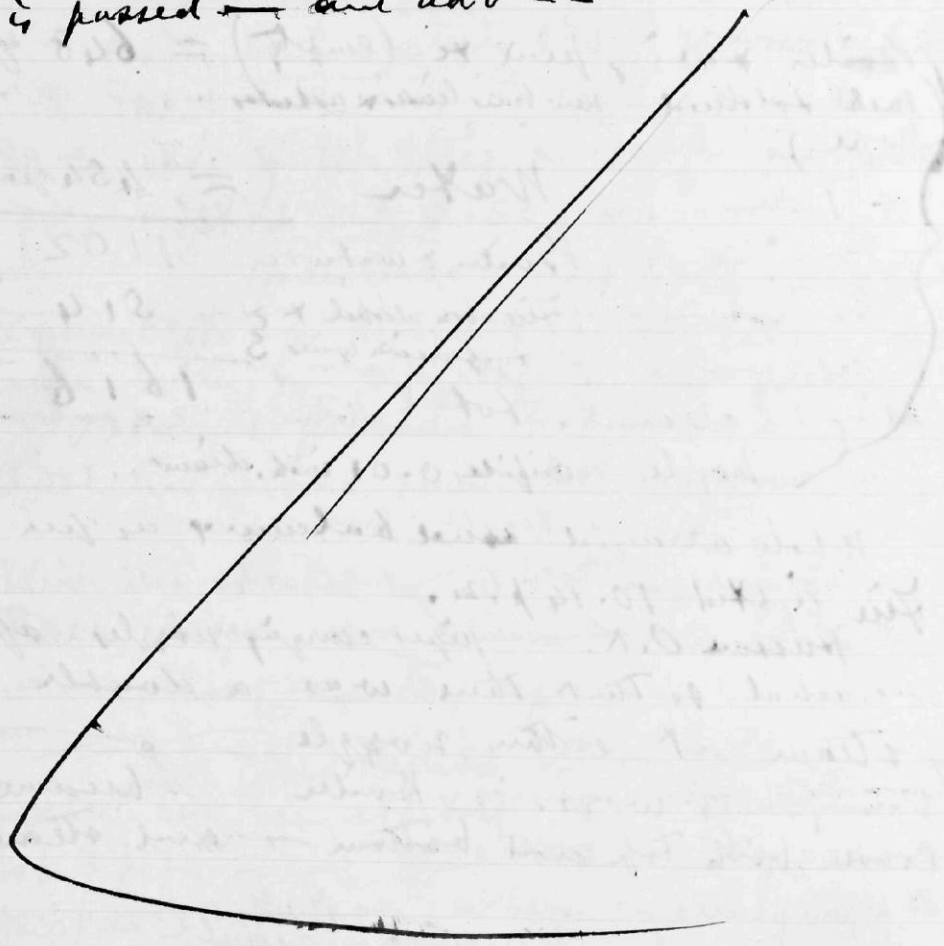
1892 June 2 — Sat — at Wkh

pipe constituting framework & wing — Too small diam.

Will make another wing-piece — & larger and longer piping. — and make two or three sizes & nozzles to screw on.



Weight Let a b c be the pipe through which steam Wt. mag. is passed — and a d b e c



1892 Jan. 4 — Monday — at ~~Lab~~.

Result of Exp. 2 p. 4.

Moulds No. 1, 2, 3, & 4 made Tuesday morning Dec. 29th. 1891.

~~Mould No. 3~~

Mould No. 1 Tight Dec. 30th. Loose but sticks Dec. 31st. (removed Jan 1st.)

2 Tight. Dec. 30th. Tight Dec. 31st. — removed Jan 2nd. started in morning & loose by noon

3 Loose Wed. Dec. 30th. – removed Dec. 31st. (see p. 13)

4 Loose Wed ~~Dec.~~ 30th. (p. 13) very loose but stuck (31st) removed Dec. 31st.

	~~Dec.~~ 29	Dec. 30	Dec. 31	Jan. 1	Jan 2	~~Jan 3 Jan~~	~~Surface~~ Condition of Observations Jan. 4. air-holes. Ver.
No. 1.	made	~~Loose~~ Tight	Loose but sticks	removed			
2.	made	Tight.	Tight.	~~Tight. started in morning loose by noon removed.~~	started in morning loose by noon removed.		
	made.	loose	removed				
	made	loose	removed.				

p. 13

	Manipulation p. 4: Brushed	Manipulation p. 4: Steamed	Dec. 29 (p. 4)	Dec. 30	Dec. 31	Jan 1	Jan 2	Jan. 2: Surface	Jan. 2: air-holes	Jan. 4: Surface	Jan. 4: air-holes
Mould No. 1	no	no	made	tight	loose	removed	—	gloss	many & large	no gloss	many & large
2	no	yes	made	tight	tight	~~tight~~	loose removed	beautiful gloss	many & small	no gloss	many & small
3	yes	no	made	loose	removed	—	—	no gloss	few & small	no gloss	few & small
4	yes	yes	made	loose	very loose but sticks at one end. removed.	—	—	no gloss	very few & small.	no gloss	very few & small a good looking record.

No material difference in hardness — no powder in the brushed records (3, 4). Ozok. cylinders pretty clean — No. 2 being the cleanest. When No. 2 ~~cylinder was~~ ~~exposed~~ withdrawn from mould on Saturday — both Mr. Ellis & I were struck by the beautifully glossy appearance of the mould — very different from 3 & 4 which showed no gloss. No. 1 also ~~was~~ visible ~~——~~ glossy but much more so than 3 or 4. Today — no difference of gloss noticeable — Nos. 1, 2, 3 & 4 alike in this respect. Weather damp — raining outside — may perhaps have some effect — will notice whether gloss returns to No. 2 when weather is fine.

1892 Jan. 4 — Monday at BBL

These experiments confirm us in our belief — that! ——

(1) Brushing plaster on to a rotating cylinder — markedly reduces the number & size of blow holes in the moulded record — but injures the plaster surface because particles are interfered with when they are setting — just at time they should be left alone. Thinness & shell brushed on leads to setting very quickly — adhesion is weakened — and record surface apt to be shabby or powdery.

2. Stirring plaster en masse while cylinder is stationary in it — gets rid of large air-holes or bubbles — which cause & surface of plaster when stirred. The large amount of plaster retards setting — so that plaster does not sensibly set till after stirring is over. This succeeds well with plain cylinders — having no voice records upon them — but stirring insufficient to get rid of air in the grooves of the record — and moulded record shows multitudinous pits or depressions — like fly-specks upon a wall — but smaller.

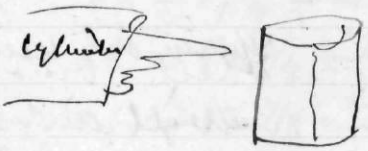
Used at once

On Saturday (Jan 2) thought suggested itself from such considerations as these — to brush the wax cylinder — while in the mould of liquid plaster. For example — as Mr. Ellis suggested — use a soft tooth brush and brush surface while it is in

of wax record liquid plaster. Brushing would be completed

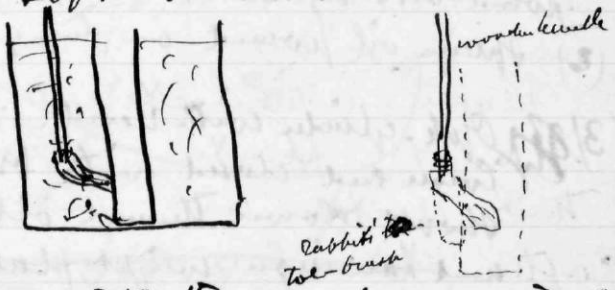
before plaster sensibly sets. This really is a combined brush and stir.

Expt. 1. Plaster 60 p.c. – water 40 p.c. – Temp. of water 80° F. Oper. cylinder closed at bottom. ‖. Split brass



was placed on board and liquid plaster (proportions & temp. above) poured in — about half-full.

Oper. cyl. was then stood upright in liquid plaster — and surface of cylinder was brushed with the toe of a rabbit's paw – (toe nail removed) This makes a soft brush.



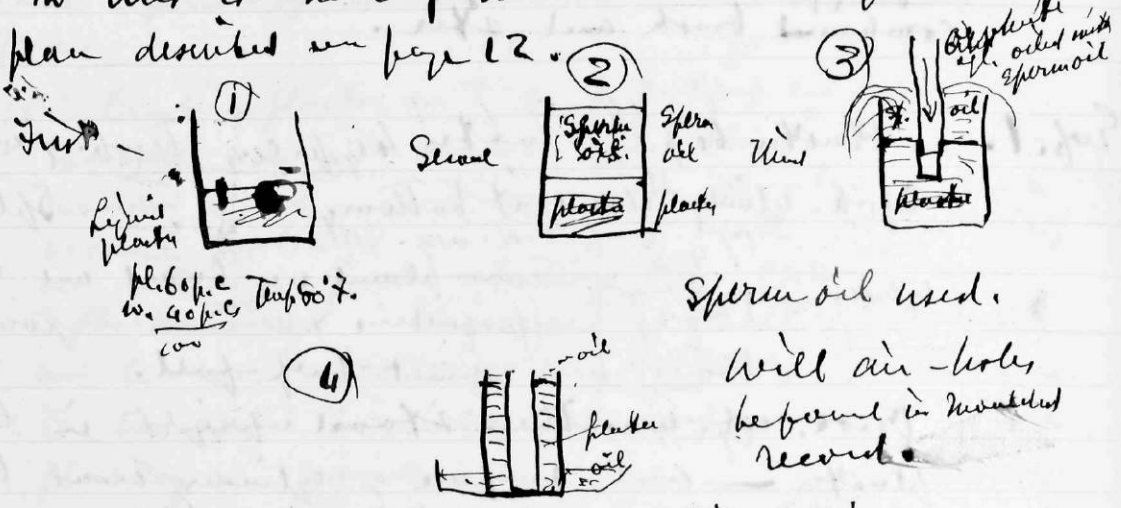
Expt. 2. W. Ellis made ~~another mould~~ in this way ~~which we shall make~~ using a large brass cylinder. This makes outer circ. of plaster round very much larger.

Expt. 3. W. Ellis is making another mould in same way but using a soft tooth-brush in place of the rabbit's toe.

Hy[illegible] cyl. Stir the plaster with the mould itself! This will probably get air out of ~~plaster~~ oper. grooves.

1892 Jan. 4 — Monday — at Bath

Exp. 4. Mr. Ellis is making another mould upon plan described on page 12.



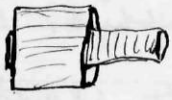
(1) 60 p.c. plaster 40 p.c. water at 60°F. mixed and poured into tin can.

(2) Sperm oil poured on top of plaster liquid.

Exp. (3) Cyl. cylinder with record — oiled with sperm oil. Lower end closed with brass disk. Cylinder thrust slowed down through oil into liquid plaster — and an iron weight placed on top to keep it down while plaster hardening.

Tried to unsolder bottom of tin can — but did not succeed. Then applied blow-pipe to seam on side of can — unsoldered it — and took bottom off. Heat transmitted through plaster may have melted wax. surface.

Left to dry.



N.B. Mr. Ellis now at work upon new wing-piece for flying-machine. Thicker and longer pipe.

Over

1892 Jan. 4 – Monday – at Bath –

Total length 8 feet.

ab = 2 ft 11 3/4 – diam. extern. $\frac{44}{100}$ inch.

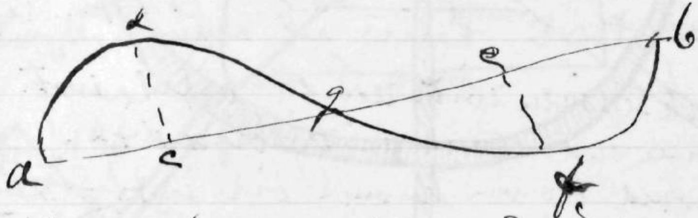
bc = 17 1/4 inches – diam. ext. $\frac{37}{100}$ inch.

cd = 12 3/4 inch diam ext. – 31/100

ef = 12 7/8 inch. diam ext. 31/100

ae = 17 3/8 inch. diam ext. 37/100

Weight 383 grammes.



~~Length ab = 5 ft 9 3/4 inches~~

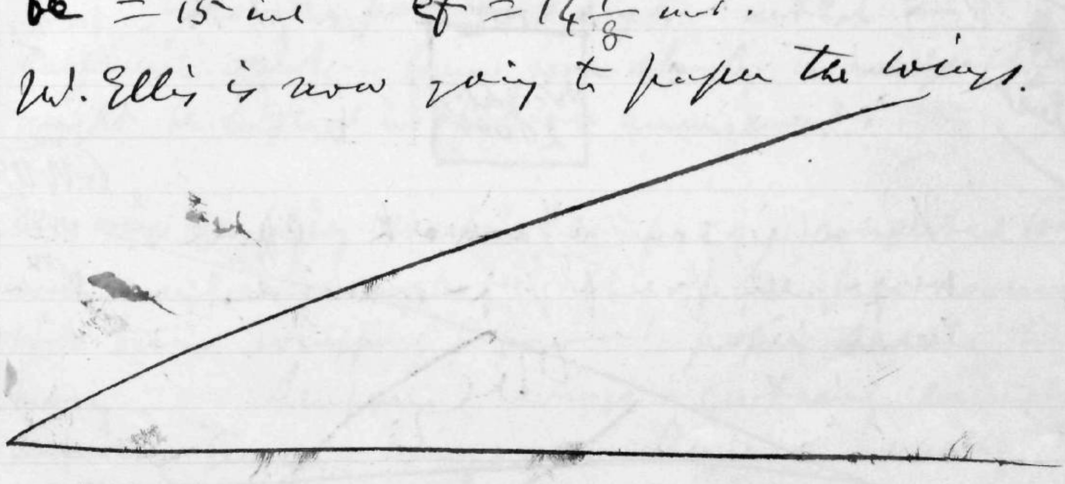
Length ab from nozzle to nozzle = 5 ft 11 3/4 inches

Length ag = 3 ft. bg = 2 ft 11 3/4.

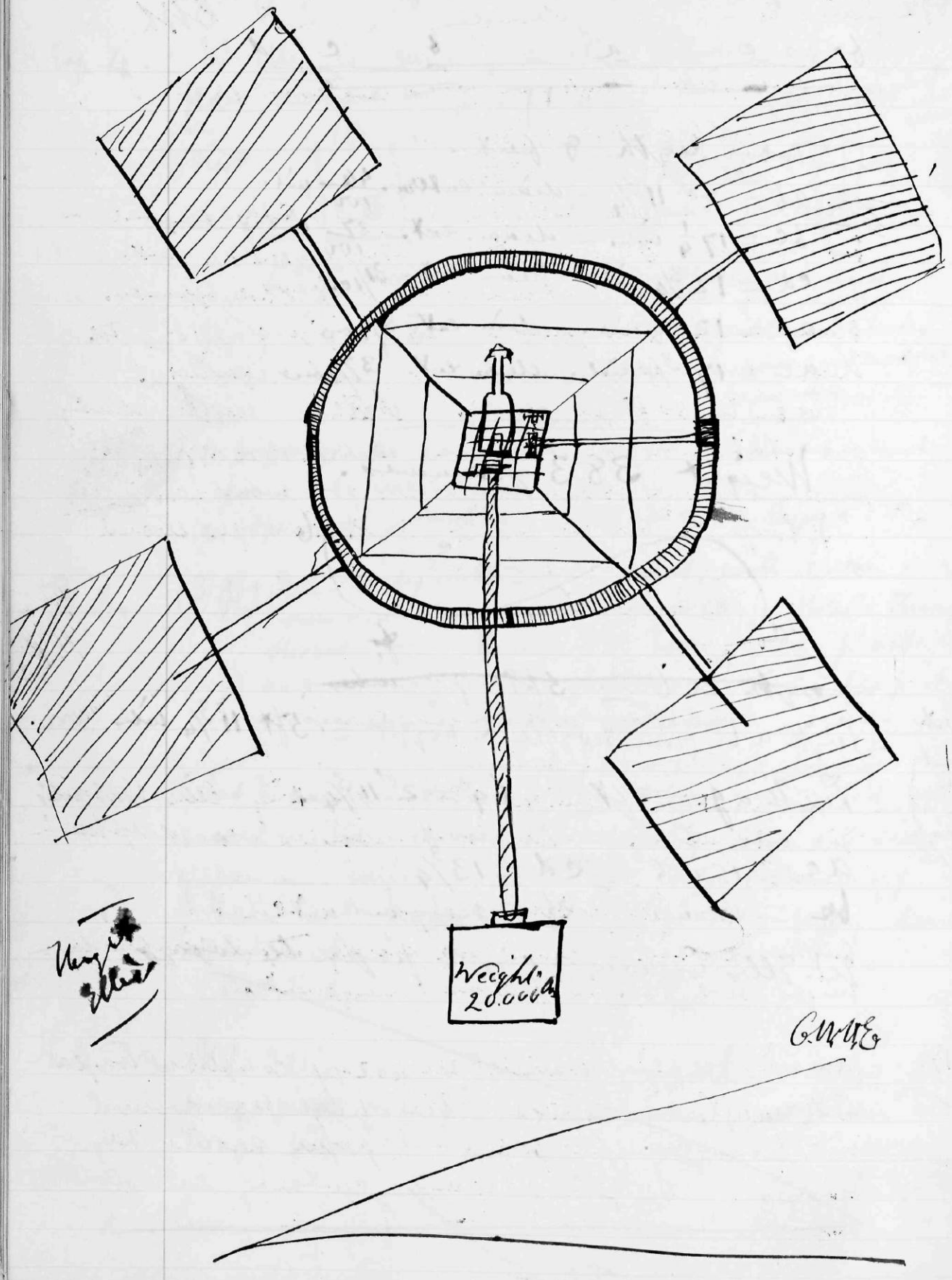
ac = 15 inch. cd = 13 3/4

be = 15 inch ef = 14 1/8 inch.

W. Ellis is now going to paper the wings.



1892 Jan 4th — Monday — at B.B. Lab.



1892 Jan. 4th — Monday, at Bth

17)50(3 turns per sec. Angle of our wings was about 15° — —
$\frac{51}{2}$

174)623(3.5 17)36.7(2.1
522 34
1010 27

Our new wing frame will give an area of wing surface — not more than 3 square feet — between 3 & 4 sq. feet. Angle very small — 2° not more than 5° — If whole apparatus should weigh 1500 grammes — Langley's figures (p. 107 of this Memoir) should give us speed of nozzle required.
49.8 — try 50 ft per second. Path of nozzle during one rotation = 18 feet hence: 50 ÷ 18 = 2.77 rotat. per second should soar if weight does not exceed 1500 grammes.

18)5.0(2.7
36
140
126
140

If Langley's figures are correct 3 rotations per second should cause apparatus to soar.

60)136 rot. per min
2.26

Thought. Qu. Why not use compressed air instead of steam — ? ——

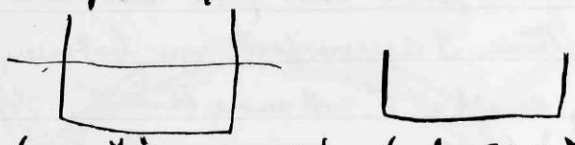
Thought — How about a chemical engine — operating like Babcock's Fire extinguisher. Bicarbonate of soda & sulphuric acid.
Chlorate of potash & sugar acted on by sulphuric acid — burns more slowly than gunpowder — might be employed in firework arrangement.

N.B. New wings for flying-machine (see p. 29) completed tonight with exception of nozzles. They have been covered with brown wrapping paper — paper seems very heavy. Surface of wings certainly exceeds surface of Turkey's wings. Angle of wing to

1892 Jan. 4 — Nevada — cat ~~Off~~

horizontal plane made as small as practicable. Certainly under 5° — may be as small as 2° — hope to say between these two — will measure tomorrow.

Tires to be cut down one half — & unnecessarily heavy — inside not used more

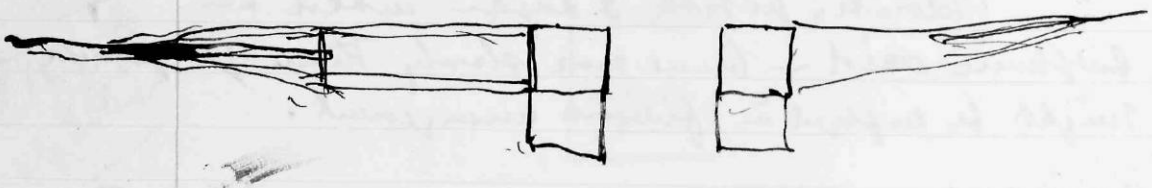


than a fraction of elevated contents. Will cover with tin plate having a circular hole & tube in it for weights. Will try weights & cotton-waste.

Think fins can be made better — and fin-box lighter.

~~4 Jan 1892~~ 10 rotations per minute = 180 ft per min. or 10800 ft per hour

10 rotations = 180 ft. — per minute = 10,800 ft or 2 miles per hour
20 " = 360 ft. " " = 21,600 ft or 4 miles per hour
50 " = 900 ft. " " = 54,000 ft. or 10 miles per hour
100 " = 1800 ft. = 108,000 ft or 20 miles per hour
150 " = 2700 ft. = 162,000 ft or 30.68 miles per hour

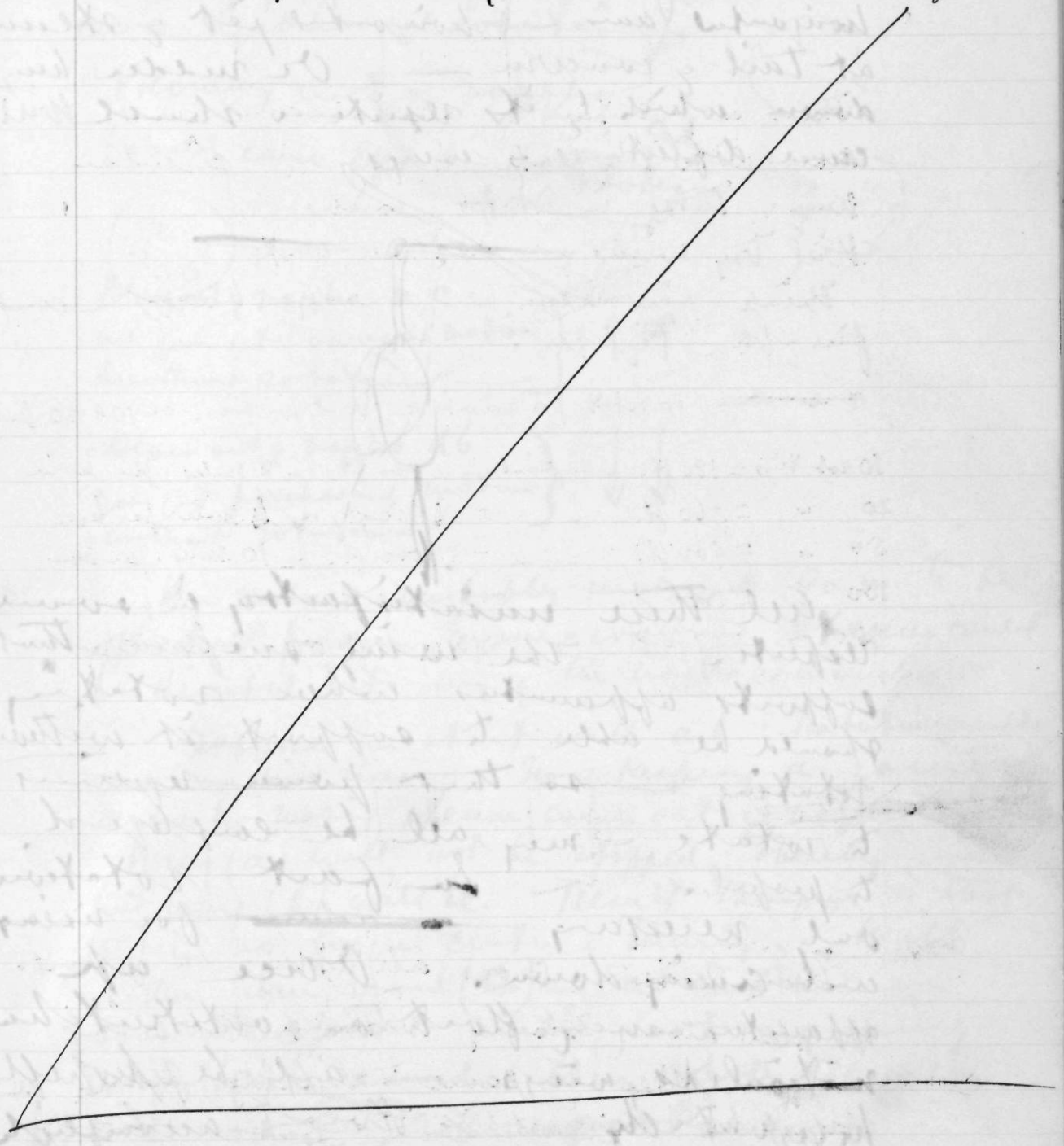


Today noticed crow alighting on ground. He flew along slowly without moving wings. When he came to alighting place, he stopped his horizontal [illegible] velocity

by changing angle of his wings. Tipped them at an angle of 45° and down he came at once.

wing while floating.

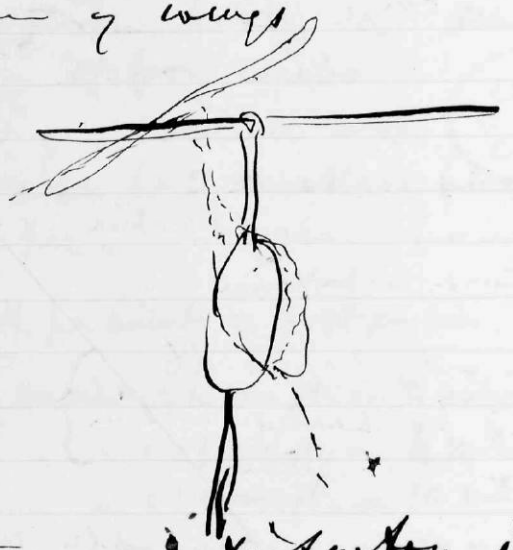
Tipped wing as shown by dotted line as he hit ground.



1892 Jan. 5th — Tuesday — at Allahabad

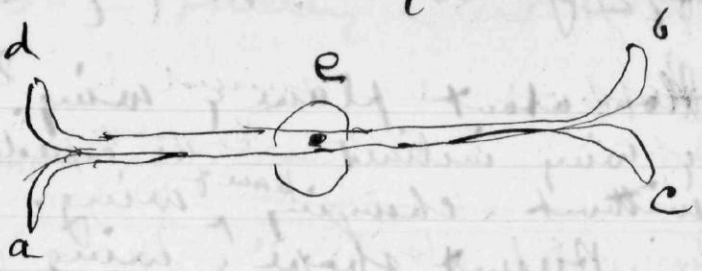
Myself

Suppose we succeed in making a machine which will screw its way up into the air — how are we going to get horizontal velocity. Many ways suggest themselves for example — paddle wheel with horizontal axis — horizontal jet of steam at tail of concern — Or rudder being down which by its reaction should cause deflection of course



All these unsatisfactory in some respects. The wing surface that supports apparatus while rotating should be able to support it without rotating — so that power required to rotate — may all be employed to propel. In fact rotation only necessary for rising and coming down. Once up apparatus may float on outstretched motionless wings — and be propelled horizontally. How to accomplish

this.



Blowing jets out of nozzles ab would cause right handed rotation

Blowing out of nozzles cd would cause left handed rotation

Blow out of nozzles ac and you get onward motion without rotation

Blow out of nozzles db you get backward motion without rotation

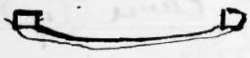
By valves suitably arranged so as to be operated from Engine-room — steam could be directed into any of the nozzles as desired.

Suppose we start with ab. Rotation results and machine rises. Now keeping a going —

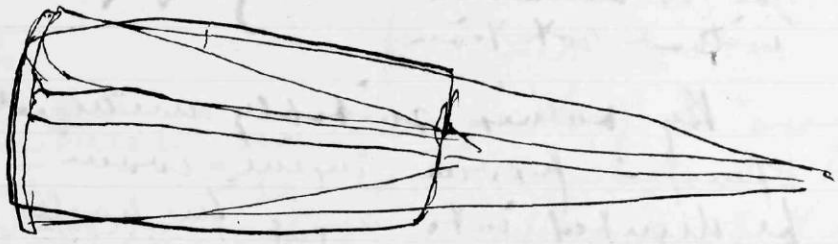
1892 Jan 5 — Sunday — at Ubly.

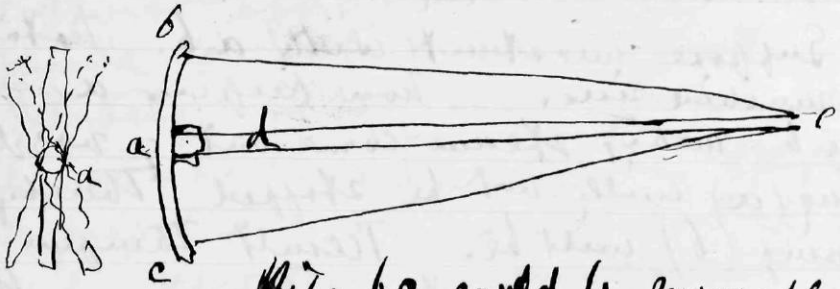
How about plane & wing? & plane & wing inclined — or conduit back — without changing plane & wing.

Present shape & wing mounted to this. How about barrel hoop wing — covered with cotton — or paper



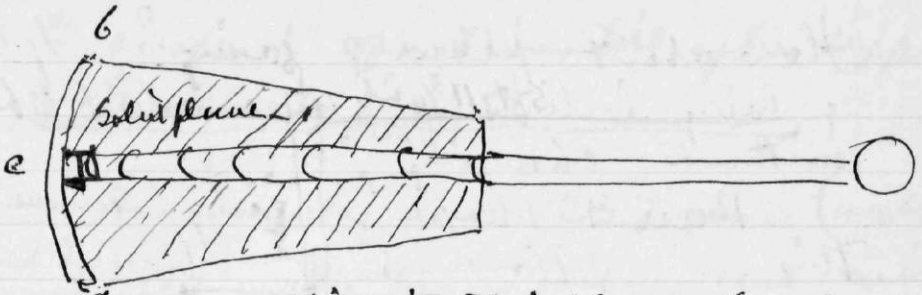
material — but not flat like a drum — but canoe shaped by having bows (a b) a little greater in length than diameter of hoop. Surely this would go up however they were thrown.





Pipe bc could be movable about axis (a) and be capable slight motion so as to tip the plane & the wing up or down as required. Water cock next & arrangement inside pipe d — could cause steam to issue only from the lower nozzle.

1892 Jan. 5 — Tuesday — at Wbk.



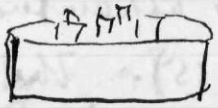
Provide means of tipping this plane forward causing holes in central pipe at (c) — so that escape is always at lower nozzle (a) or (b) ~~as for (c)~~

Exp. 1. Mr. Ellis is now ready to try new flying machine.

Same boiler as in last experiment — Exp. 3 p. 23 — but everything else new.

Old fire box has been cut in one half as shown by dotted line a–b — and lower half ~~used~~  into a new fire-box.

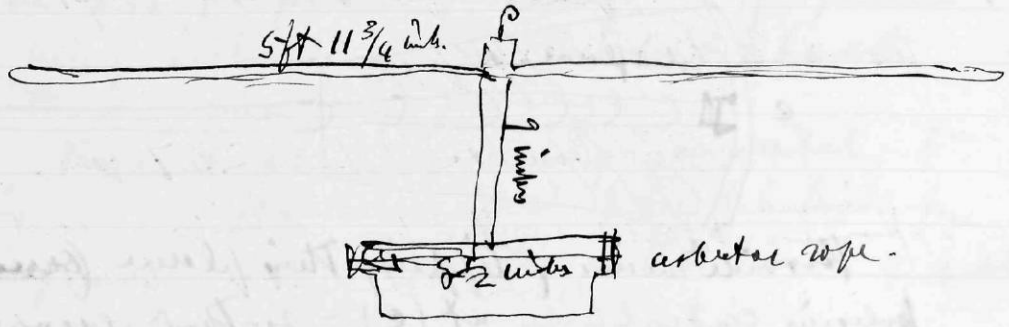
Steel & tin soldered on top with fire holes —  a for fire wires — besides a small vent hole (a). Into wire-holes have been soldered tin pipes one inch long and 5/8 inch diam —  for wires

Diam. of fire-box = 4 inches
Depth external = 1 3/4 inch. 

Weight of empty fire-box without wires — or suspension wires — 107 grammes. Mr. Ellis has made a very nice swivel joint of brass —  to suspend apparatus — turns easily.

1892 Jan. 5 — Tuesday — at Alfh

Exp. 1
cont.



Boiler and attachments = 1025 grammes.

Fire-box - with cotton-waste wicks and three iron suspension wires = 125 grammes.

Boiler + attachments	= 1025	(weighed)
Fire-box + all	= 125	weighed
Total	1150	(calculated)
empty Apparatus Total	1150	(weighed)
Alcohol	100	(weighed)
Water	362	(weighed)
Total weight + boiler apparatus	1612	(calculated)

Same weight as apparatus used Dec. 31st 1891 - (in Exp. 2 p. 14-15). The nozzles also have orifices of same diameter as in that experiment viz 0.0235 inch (see p. 8-). In Exp. made Dec 30th (p. 15) - apparatus made 136 rotations per minute. = 1020 ft per minute = 61,200 ft per hour = 11.5 miles per hour.

1892 Jan. 5 — Tuesday — at Bkl.

Exp. 1 Cont. Had to suspend operations till after supper. Now 8 o'clock p.m.

Fire-box &c = 237 gms. (weighed)

~~Poured~~ Siphoned out cold water from boiler — and will now re-fill with hot water — to make total weight 1612 grams. This will require 350 gms of water.

The fire-box has increased in weight since we have been at supper.

Before supper 225
After supper 237
Difference 12 grams.

Can it be that alcohol has absorbed moisture.

~~Wt~~ ~~350 gr~~

Hot-Water	350 grams	(weighed)
Empty boiler & attach.	1025	(see p. 38.)
Boiler & water	1375 grams	(calculated)
" " "	1367 "	(weighed)

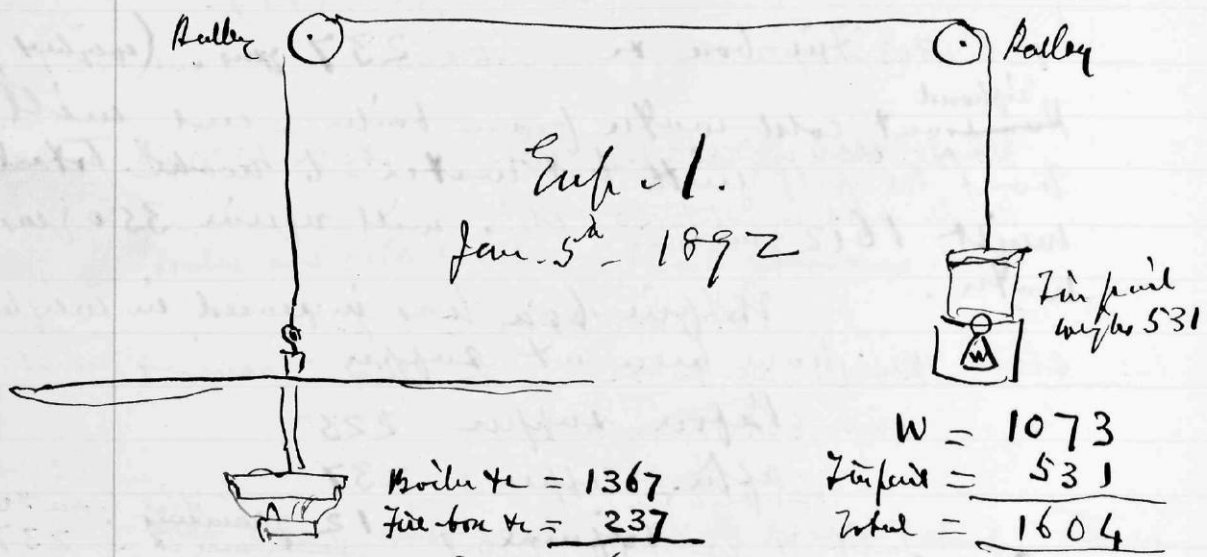
Full Boiler &c —	1367	(weighed)
Full Fire box &c —	237	weighed
Total	1604	

Over

Expt 1 Cont.

1892 Jan. 5th — Tuesday at 12½.

All ready now arranged as before



Expt. 1.
Jan. 5th – 1892

Fire lighted at 8.25 p.m.

8.30 p.m. 8¼ revs. in 15 seconds.

8.31 p.m. 7½ revs. in 15 seconds.

~~8.32 p.m.~~

8.32 p.m. Rotation increased a little — think about 8½ revs. in 15 seconds — or more. Apparatus rose to the pulley — and 100 grams weight had to be taken out of tin-pail.

Present — John McKillop Esq, Ellis & self.

After a little while a leak appeared in the boiler which compelled us to stop experiment.

One of the nozzles was partially plugged so steam came out of one more than another.

8½ revs. in 15 seconds = 34 revs. per minute.

Speed of nozzle = 34 × 18 ft = 612 ft per minute.

10.2 feet per second.

1892 Jan. 5 — Tuesday — at Ch.

Expt 1 cont.

Experiments with small machine — same sized nozzle as used today — and same boiler — same following results (see Expt 2 p. 15).

136 rotations per minute = 136 × 90 inches = 12,240 inches = 1020 ft.

Nozzle used in Expt. 2 p. 15 moved at rate of 1020 ft. per minute
Nozzle used in Expt. 1 p. 40 " " " " 612 ft. " "

Expt 1 At conclusion of Expt. 1

Boiler water &c = 1296 grammes (weight)
Fire-box alcohol &c = 189

Boiler &c.	Fire box &c
Initial weight = 1367	Init. weight = 237
Final weight = 1296	Final " = 189
Water consumed = .71 grm	Alcohol burnt = .48 grm

Experiment did not last five minutes.
Boiler cooled — and one nozzle partially plugged up.

We unanimously agree to unload boiler and repeat the experiment.

Fire-box — great improvement — burns with much better flame. Five wicks.
The defective nozzle has been cleaned out — and boiler is being re-soldered.

Expt. 2.

Boiler &c	Fire-box &c
Initial weight = 1824	Init. weight = 310 grammes
Final weight = ———	Final weight = ———
Water consumed = ———	Alcohol burnt ———

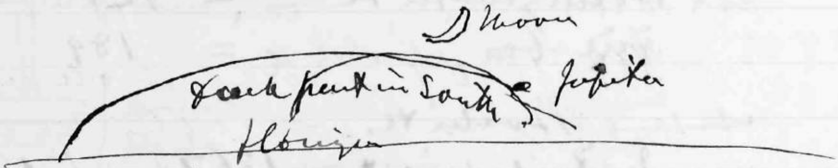
(for details see over)

Experiment commenced at 9.27 p.m.
Experiment ended at ——— p.m.
Remarks & expln. ———

1892 Jan. 5 — Tuesday — at [illegible]

Exp. 2 contin. Have left blanks at foot of p. 41 to be filled up when machine is ready for Expt.

N.B. 9 o'clock p.m. have just been walking round verandah of Lab. to kill time while W. Ellis is finishing repairs. Evidently going to have a splendid display of aurora — Many streamers ~~of~~ form a covering over whole sky excepting portion in the south — which looks like a dark arched space by contrast



Will observe it after moon has set — and note results.

Exp. 2 contin.

Total weight of apparatus = 2134 ~~[illegible]~~ grammes —
Fire lighted 9.27 p.m.

At 9.31 p.m. — 26 rot. per minute
One wing doing all work. Little or no steam escaping from other.

Stopped machine — W. Ellis has fixed it so that by lowering on to floor — the fire box becomes unhooked. Then we raise boiler out of way and blow out flames. Boiler leaks.
Upon removing defective nozzle — a great gust of steam came forth — After we have made experiment ~~[illegible]~~ we intended to do — in a satisfactory manner — Will try apparatus without any nozzles at all.

1892 Jan. 5 — Tuesday — at 12 Bk —

Nozzle found plugged with a little clip — looks like fragment of hard rubber. Will start again. Mr Ellis is soldering up leaks in boiler.

Exp. 3. All ready to repeat Experiment.

Boiler &c = 1709 Fire-box = 340 gms

Fire lighted at 10.02 p.m.

At 10.05 p.m. rotations 33 per min.

at 10.07 p.m. — " 36 " "

at 10.08 p.m. " 36 " "

~~At~~ 10-07 — rose — took out 50 grammes.

~~at 10.09~~ p.m. — rose after the counter-poise 50 gms removed. Stopped at 10.10 p.m. to save boiler.

	Boiler &c ~~after Exp. 3~~.		Fire-box.
Init. weight	1709 gms	Init. w.	340 gms
Final weight	1615 gms	Final w.	305
Water evap.	94 gms.	Alcohol consumed	35

Exper. commenced at 10.02 p.m.
" ended at 10.10 p.m.

Duration of exp. = 8 minutes.

Result: 36 rot. per min. = 36×18 = 648 ft per min.

Three experiments with same sized nozzles viz = 0.0235 inch diam.

(1) Exp. 2 p.15 gave velocity of nozzle ~~at~~ 1020 ft. p. min.
(2) Exp. 1 p.40 " " " " = 612 " " "
(3) Exp. 3 p.43 " " " " = 648 " " "

Over

1892 June 5th — Tuesday at BBh.

Exp. 4. The weights have been removed — leaving an orifice of 0.15" and 15/100 inch. Will revolve by rotation.

Boiler = 1861 grms. Fire-box = 364 grms.

Fire lighted at 10.27 p.m.

10.30 p.m. 7½ rotations per min.

Stopped at 10.32 p.m. — not advantageous.

Exp. 5. W. Ellis will now drill out the weights used in Exps 1, 2, & 3, so as to make orifice = 0.0365 inch diam. $\frac{36\frac{1}{2}}{1000}$ inch. done.

Boiler re = 1785 grms Fire box = 304 grms

~~Fire lighted at~~. These are the weights left over from last experiment. Fire lighted at 10.34 p.m.

at 10.36 rot. 36 per min.

10.37 " 36 per min.

Suddenly started ¼ min. In hurry at down lamp unbooked. Stopped ~~started~~ put out lamp — replaced fire at 10.40 p.m. Boiler wet 100 grms — balance O.K.

at 10.42 rot. 36 per min.

Another 50 grms removed ~~to counter balance~~ from counter-balance — still rises

at 10.45½ rot. 38 per min. = 38×18 = 684 ft. per min

at 10.47 p.m. 39 per min. = 39×18 = 702 ft per min

Boiler		Fire-box	
Init. w.	1785	Init. w.	304
Final w.	1561	Final w.	203
water evap.	224 grms.	alcohol burnt.	101 grms

Exp. commenced = 10.34 p.m.

" ended = 10.48 p.m.

duration of exp. = 14 minutes.

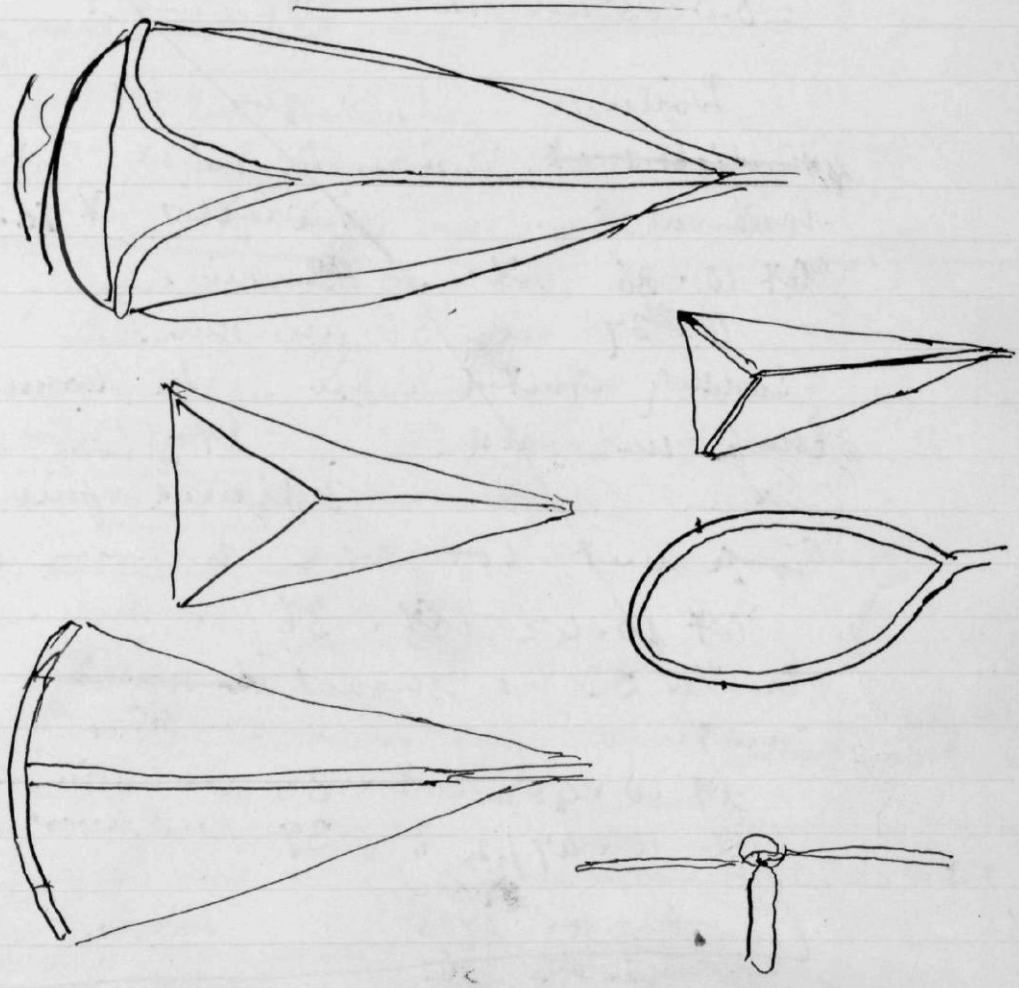
1892 Jan. 5 – Tuesday – at Wbh.

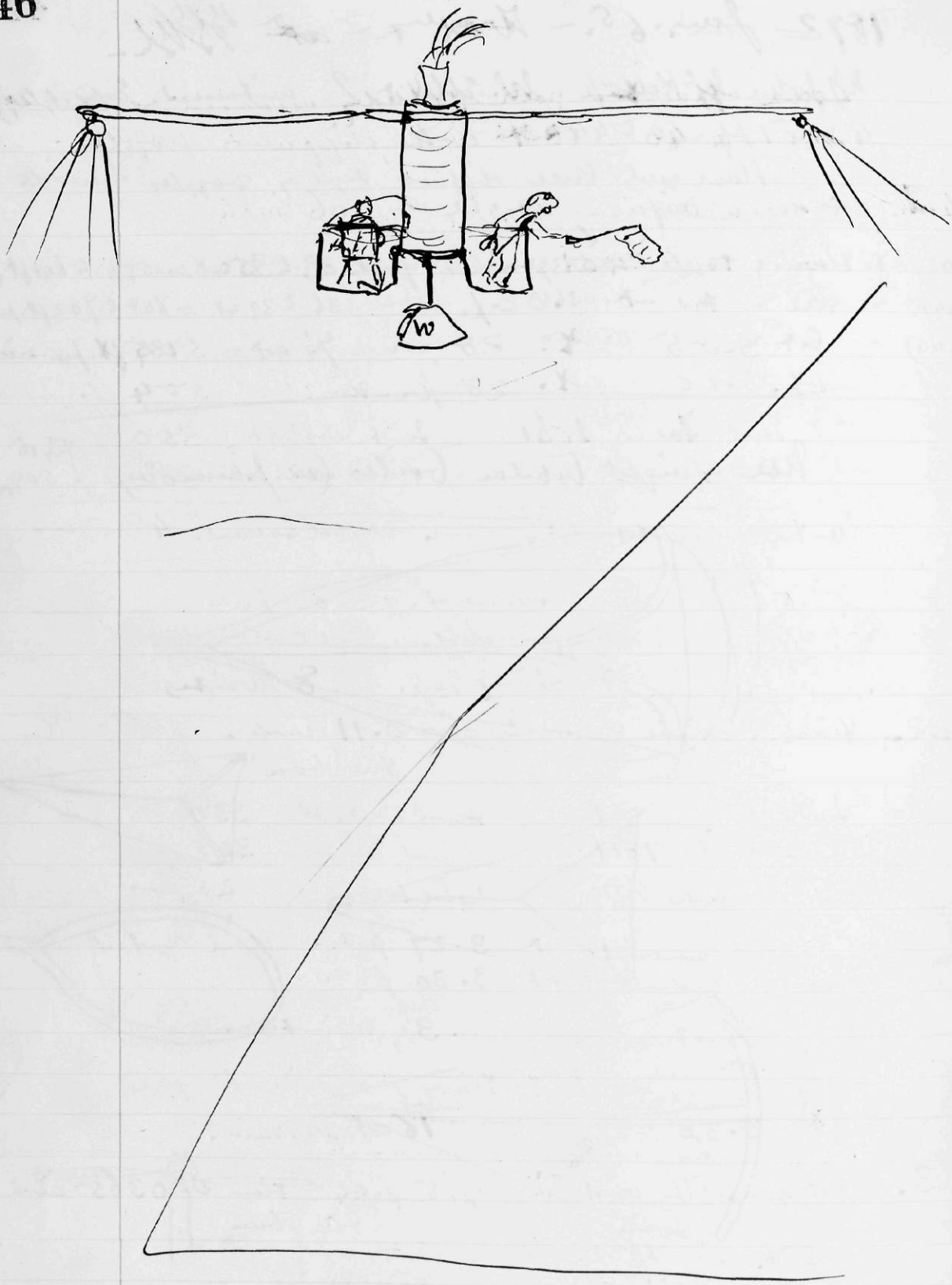
W. John McKillop, W. Ellis & I witnessed Exps. 1, 2, 3, 4 & 5 pp. 40 to 44.

Have used three different sizes of nozzles with this apparatus tonight.

(Exp. 3 p. 43) Int. Diam. of nozzle 0.0235" inch – gave 38 to 36 rot. = 594 to 648 ft. p. min.
(Exp. 5 p. 44) " " " " 0.0365" " " 36 to 39 rot. = 648 to 702 ft. per min
(Exp. 4 p. 46) " " " " 0.1500 " " 7½ rot = 135 ft. per min.

Use upright tubular boiler (see Johnson's Engr. p. 509) Fig. 16





1892 Jan. 6d. Wed — at BBL —

Same apparatus used yesterday arranged as in diag.
Exp. 1. p. 60 — but with different nozzles.

Exp. 1. Diam. of orifice of nozzle = 0.06 inch
Boiler pr = ~~1861~~ 1861 gms Fire box = 350 gms
Fire lighted at 3.02 p.m.
At 3.05 pr. 28 per min. = 504 ft. per min
At. 3.10 pr. 28 per min. = 504 ft. per min
Init Boiler weight 1861 Init. weight 350 gms
Final weight 1705 Final weight. 302

Water evaporated 156 grammes. Alcohol consumed. 48 gms

Exp. commenced. 3.02 p.m
Exp. finished. 3.10
Duration of Exp. 8 minutes

Exp. 2. Diam. of orifice of nozzle = = 0.11 inch.

Boiler		Fire box	
Init. weight	1861	Init. weight	350
Final weight	1811	Final weight	325

Water evaporated 50 gms Alcohol burned 25 gms.

Exp. commenced at 3.27 p.m. (fire lighted)
Exp ended at, 3.30 p.m.

Duration of Exp. 3 minutes.

Rotations per minute of nozzle.
Time — Rotations
At. 3.30 — 16 rot. per. min.

Exp. 3. Same nozzles used in Exp. 5 p. 64 — diam 0.0365 inch.

Boiler		Fire-box	
Init. weight	1861 grammes	Init. weight	350
Final weight	1721		305
Water evaporated	140 grammes	Alcohol consumed	45 grammes

Exp. commenced at 3.45 (fire lighted)
Exp. finished at 3.52 (fire just out)
Duration of Exp. = 7 minutes.

1892 — Jan. 6 — Wed — at Ush

Exp. 3 cont.

Rotat. 36 per min. at 3.48
40 per min. at 3.50 p.m.
43 per min. at 3.51
43 per min. at 3.52 p.m.

Exp. 4 cont.

Nozzles removed entirely. Similar experiment to Exp. 4 p. 44 Diam. of orifice = 0.1500.

Boiler		Fire-box	
Init. w.	1861	Init. weight	350
Final w.	1806	Final weight	328
Water evaporated	55	Alcohol consumed	22

Exp. commenced 4.00 p.m. (fire lighted)
Exp. finished 4.02 (fire left out)
Duration of Exp. 2 minutes
Rotations:
At 4.02 p.m. 8 rots per min.

Exp. 5.

New nozzles have been made with orifice = 0.0235 inch same size as those employed in Exp. 3 p. 43.

Boiler		Fire-box	
Initial weight	1861 grms	Initial weight	350 grms
Final weight	1765	Final weight	302
Water evaporated.	96	Alcohol burned	48

Exp. commenced at 8.03 p.m. (fire lighted)
Exp. ended at 8.09 (fire left out)
Duration of Exp. = 6 minutes

At 8.05 p.m. — 29 rots per min.
" 8.07 " " 30 " " "
8.09 " " 30 " " "

Boiler held all right — but commenced to leak after fire was put out — while cooling. Now emptying boiler — for experiment with fine nozzle.

1892 June 6 — Wed — at Ilsley

Exp. 6 Nozzles with orifice 0.0100 in diam'

Boiler		Fire-box	
Initial weight	1861 grs	Initial weight	350
Final weight	1058	Final weight	295
water evaporated	803!	Alcohol burned	55

boiler burst

Exp. commenced at 8.38 p.m.
Exp. ended at 8.45 p.m.
Duration of Exp. 7 minutes

22 rotations at 8.38.
22 rot. at 8.45
Just as I was noting this — boiler burst.
End of boiler No. 2. — and end of Exp. 6.

Resumé.

	Diameter orifice of nozzle	rotations per minute	Velocity of translation of nozzle: Velocity of nozzle in feet per min	Velocity in feet per second	Velocity in miles per hour	Economy of fuel & water consumed: Exp. in minutes	water evaporated	Alcohol burned	Fuel & water consumed per minute: Water consumed per minute	alcohol consumed per minute
Exp. 4 p. 48	0.1500 inch	8 rot.	144 ft.	2.4 ft	1.6 miles	2	55 grs	22 grs	27.5	11.0
Exp. 2 p. 47	0.1100 inch	16 "	288 "	4.8 "	3.3 "	3	50	25	16.6	8.3
Exp. 1 p. 47	0.0600 inch	28 "	504 "	8.4 "	5.7 "	8	156	48	19.5	6.0
Exp. 3 p. 47	0.0365 inch	43 "	774 "	12.9 "	8.8 "	4	140	45	20.0	6.4
Exp. 5 p. 48	0.0235 inch	30 "	540 "	9.0 "	6.1 "	6	96	48	16.0	8.0
Exp. 6 p. 49	0.0100 inch	22 "	396	6.6	4.5 "	Boiler burst.				

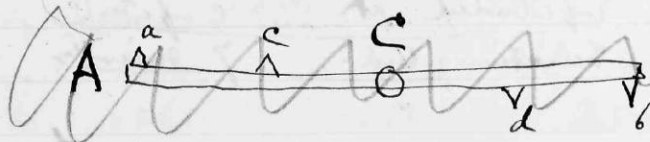
by Boiler burst.

Noted at Kew Observatory C. V.
January 6th 1892 Wednesday
by A.S.

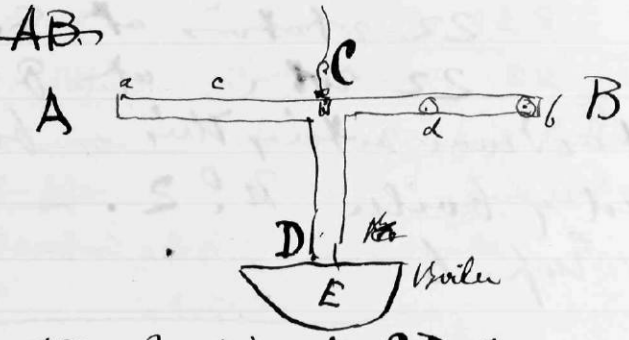
1892 Jan. 7th — ~~Thursday~~ — at BBh.

A heavy storm raging — Wind S or SW — Letters received from Europe — one from Gibraltar — other from Glasgow.

Having tested nozzles will now test best ~~place~~ location for nozzle. Want to see whether Leverage idea is O.K.

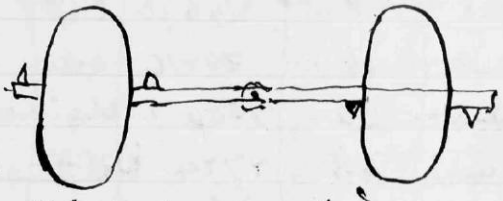


~~Straight pipe AB.~~



Straight pipe AB. Vertical pipe CD communicating with boiler E.

Jump will steam from nozzles (ab) produce a faster or slower rotation than steam from nozzles (cd.)? Try first with bare pipe. Then load pipe with tin wings between (ac) and (bd) Thus:



and see whether this makes a difference. Solder tin wings to pipe. Un-necessary for purposes of this experiment to carry up fire box. Suspend boiler & casing-piece over ~~the~~ fire-box — or some sort of heat — perhaps stove. Will decide when apparatus ready. Mr. Ellis is re-soldering the first boiler used — same one that came to grief. see 29/1/92

1892 June. 7 — Thursday — at Ithaca —

in Exp. 3 (p. 9).

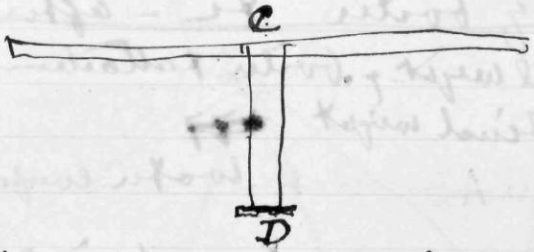
Exp. 1.

33.75

External diam. of pipe AB = 0.25 inch. Length ~~36~~ inches. Ends A & B plugged with brass. Nozzles a b c & d — diam. of orifice = 0.0235 inch.

Distance of nozzle (a) from center C = 16.6 inches
— — — (b) — — — = 8.3 "
— — — (c) — — — = 8.3 "
— — — (d) — — — = 16.6

33 inches. Dist. between center of nozzle (a) and center of nozzle d (measured.)
16.6 inches Dist. betw. " " " (b) " " " (c) (measured)



Length of stem per CD = 4.75 inch. (diameter external = 0.5 inch) Interm. diam 0.45 inch. Weight of arrangement with Screwed-joint = 138 grammes

Old boiler used ⌓ been repaired. ~~Empty weighs~~

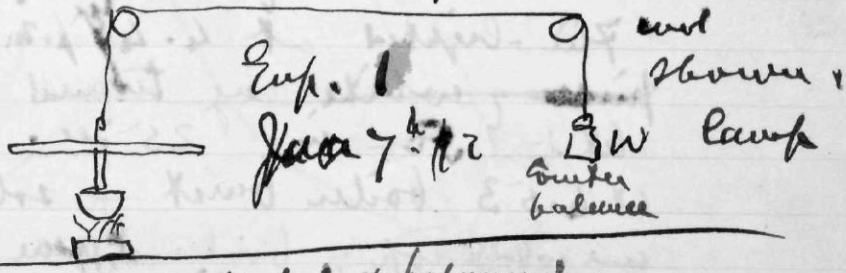
Empty boiler weighs 100 grammes.

Boiler now being filled with warm water.

Weight of boiler & water = 382.

Now will solder on wing piece.

Work completed arranged as Alcohol on floor.



and Shower & Lamp

boiler & wing piece suspended & balanced.

1872 Jan 7th — Thursday at Bble

Exp. 1. cont.

Nozzles (a) and (d) 33 inches apart open — the other nozzles plugged up.

Fire lighted at 3.57 p.m. Boiler commenced at 3.58.

4.02 p.m. at 27 lbs.

at 4.05 p.m. it made 50 rotations in 21 seconds. Fire put out.

21 : 60 :: 54 : x

60

21) 3000 (143 rotations per minute.

21

90

84

60

63

3

1180 ft. per minute
19.66 ft. per pull
70,800 ft per hour.
13.4 miles per hour.

382 boiler
138 weight piece
520

Weight of boiler &c — after experiment.

Initial weight of boiler & attachments = 520

Final weight = 477

Water evaporated = 43

Good experiment — will now try

Exp. 2. the nozzles (b c) (distance apart 16.5 inches) — and plug up nozzles a d.

Weight piece un-soldered and boiler filled with warm water to same weight as before viz = 382 lbs weight-piece now being soldered on which should bring total weight about same as before — will weigh it. Total — boiler — weight-piece + water = 530 lbs.

Fire-box on ground floor as before.

Fire-lighted at 4.43 p.m.

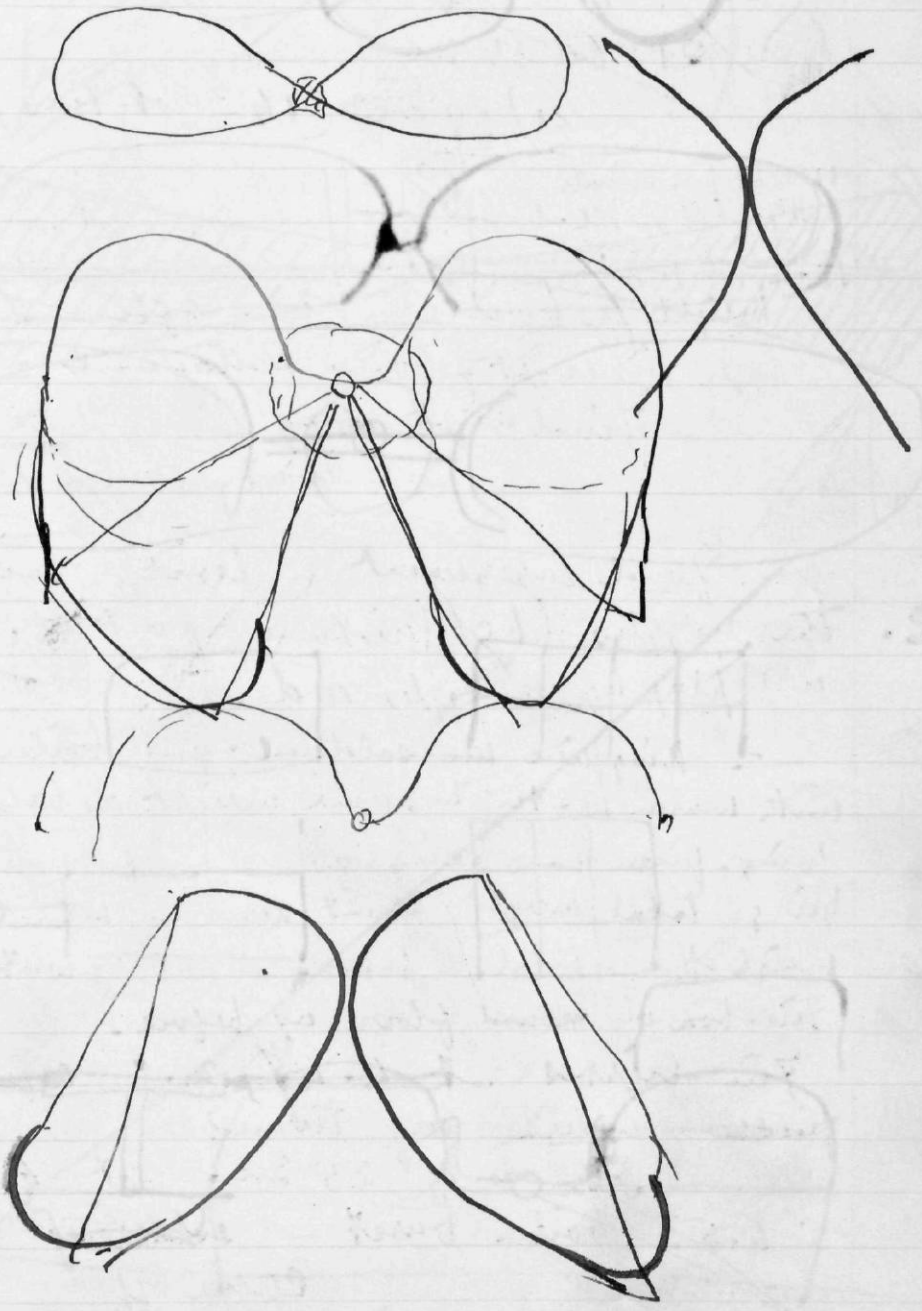
Let. Go in 25 Sec. at 4.52

at 4.53 boiler burst — soldering came out and whole top of boiler came off.

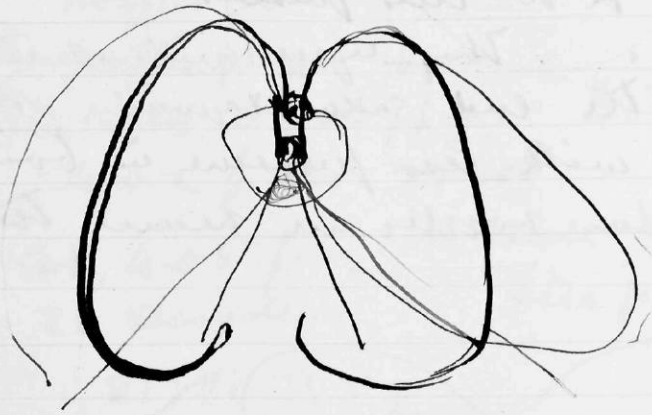
120 rotations per minute.

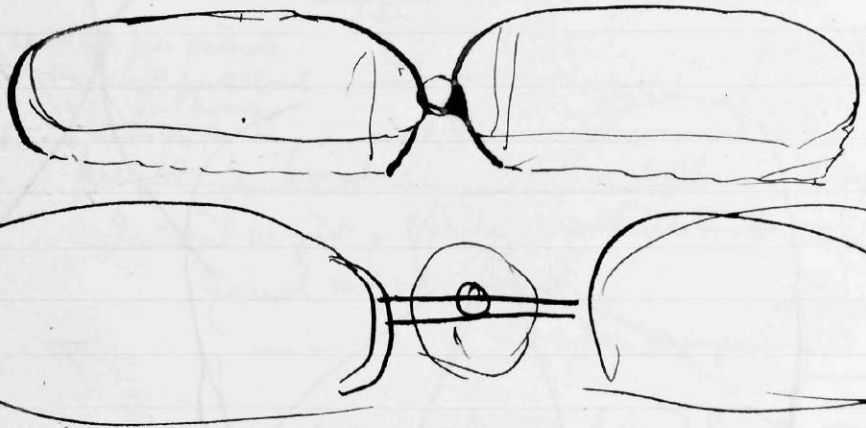
1892 Jan 7 — Thursday — at 8½h.

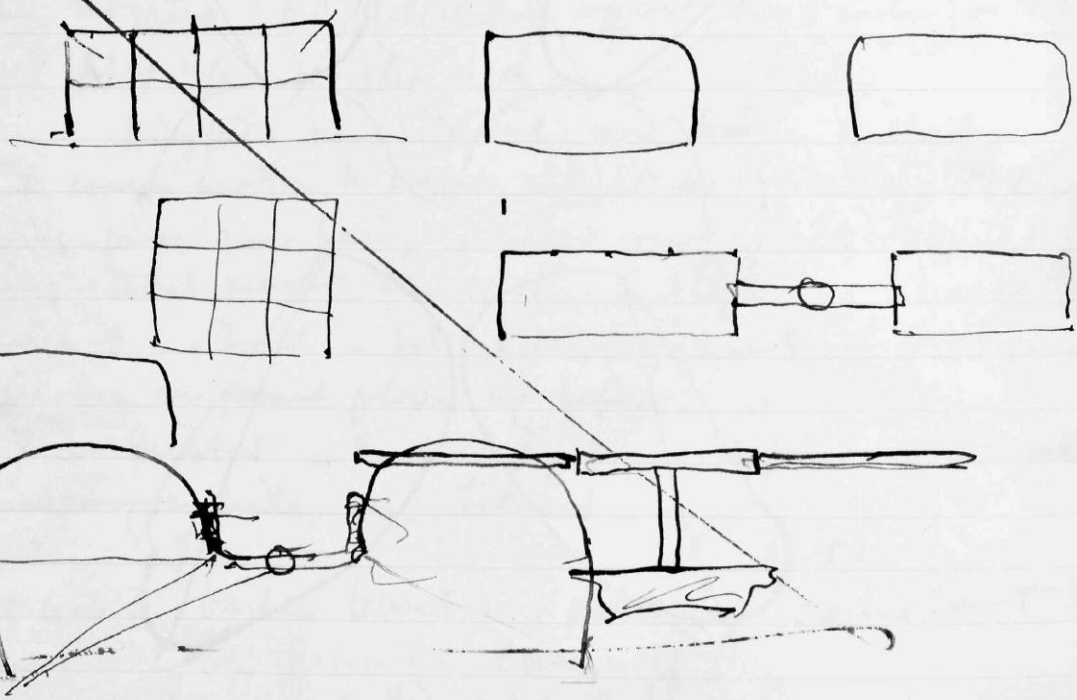
Mr. McCurdy & Mr. Ellis present at these two experiments. They agree with me that nozzle at the end advantageous. Steam & Ex passes with less pressure in boiler than when similar nozzles are near the axis.

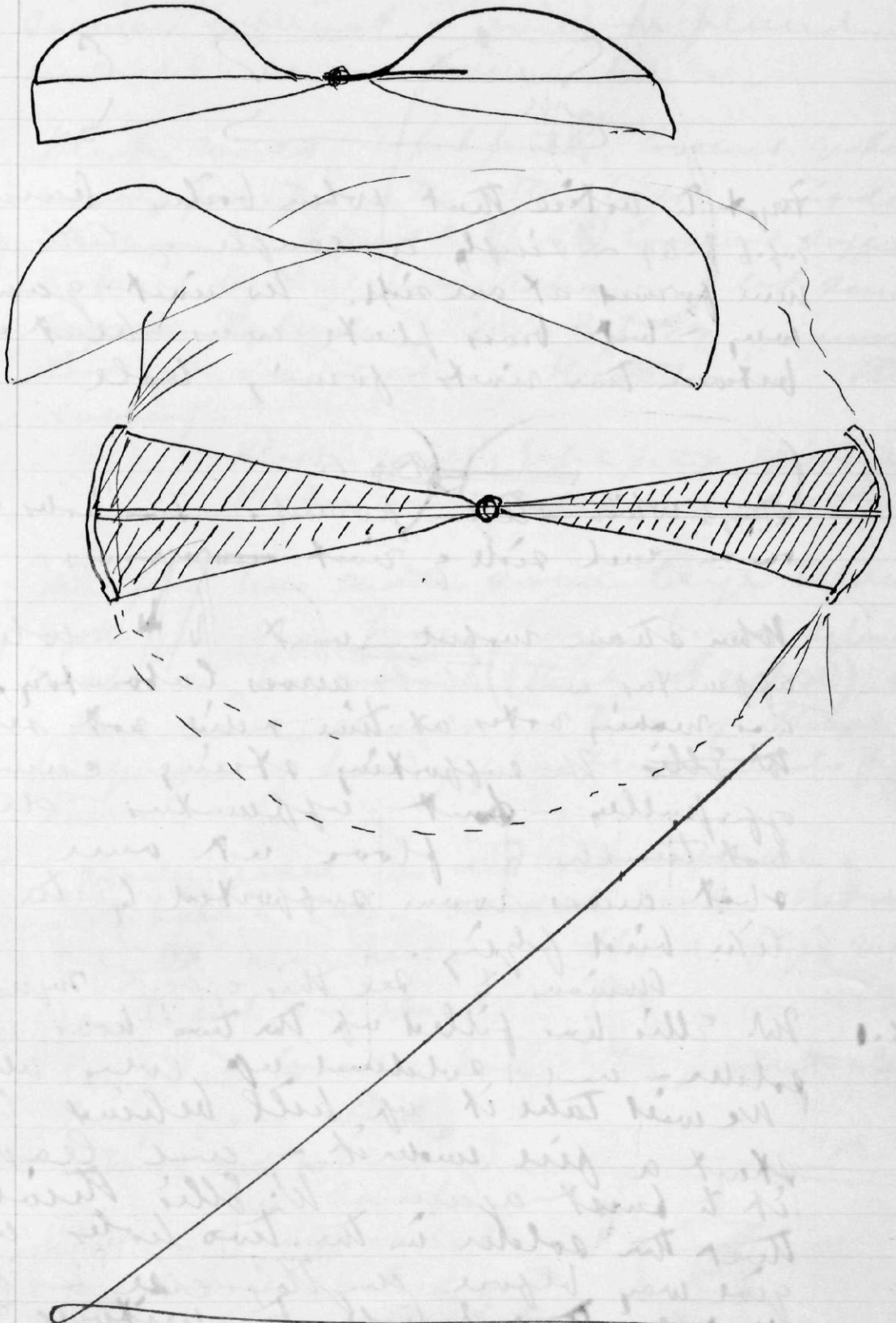


1892 Jan. 7th Thursday — at BBL.



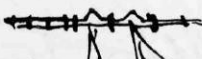






1872 Jan. 8 — Tuesday — at Ellis

Forgot to notice that when boiler burst Exp. 6 p. 49 — simply a couple of little holes were formed at one side. No rivet gave way — but brass plate was bent up between two rivets forming hole

through which steam poured. Two holes opened on each side of rivet 

When steam reached end of boiler apparatus was shot across Laboratory. I was making notes at time & did not see it. ~~The Ellis~~ The supporting string came off pulley — but apparatus did not tumble to floor at once — It shot across room supported by the wings like bird flying.

Omission to see this effect myself.

Exp. 1 Mr. Ellis has filled up the two holes with solder — and soldered up every rent. We will take it up hill behind Lee. Start a fire under it — and cause it to burst again. Mr. Ellis thinks that the solder in the two holes will give way before anything else — so that I hope to witness explosion & flying effect. Of machine

survives experiment – will be placed as model in our museum here.

N.B. Plaster model of Exp. 1 p. 28; loosened yesterday morning Jan. 7th – the other tight. Today at noon – Exposed 1 (p. 28) loosened sufficiently to leave ogok-cyl. withdrawn. At same ~~Exp. 3~~ cylinder of Exp. 3 p. 27 found loose at one end. Withdrawn this evening.

Plaster mould of Exp. 2 p. 27 still tight
Plaster mould of Exp. 4 p. 28 still tight.

Mr. Ellis has made some large tapering ogok-cylinders from large brass cylinders made in ^end of or beginning of November – (think not noted).
Have made moulds on two of these – for purpose of having plaster moulds from them.

Exp! continued. Boiler leaked ∴ so did not explode. Took back to Lab – mended leak. Returned to field near here. Stood flying machine on tripod wire stand  – over alcohol lamp in wooden box to protect alcohol lamp from wind.
Thing did not go off – When lamp went out – approached & found boiler bulged out above & below – but it had not yielded to the strain – Will repeat exper. tomorrow – bigger fire.

1892. June. 8 — Friday — at Ilfra.

N.B. Plaster mould of Exp. 1 p. 27 is I think the best plaster mould we have yet made. Surface hard and glossy — and no sign of air-holes.

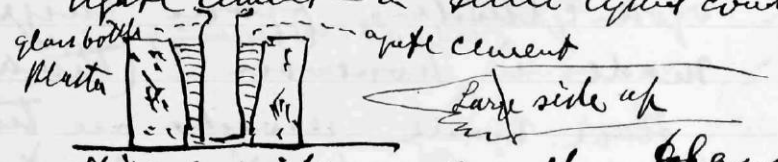
Plaster mould of Exp. 3 p. 27 also first-rate — no air-holes.

Think we have mastered that point at last.

Exp. 2. Mr Ellis is now making a plaster mould in way suggested at bottom of p. 27. Stir plaster with the agate cyl.

~~N.B. It seems obvious that on~~

Exp. 3. Little Tapering plaster mould taken with glossy surface Taken — Agate cement in semi liquid condition

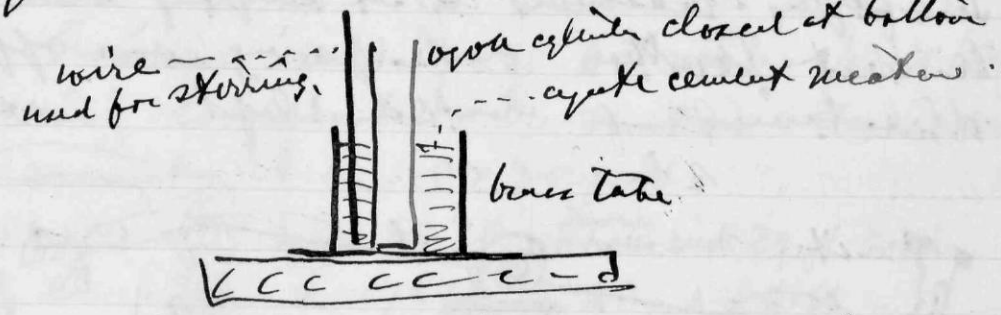


poured in — stirred with a small glass bottle and glass bottle left in as centre. Perhaps difficulty with agate cement beginning in probable fact that plaster surface was broken — or in a disintegrated condition — so that agate cement united with plaster. Will try whether fine glossy surface of plaster adheres to agate cement.

~~Exp. 4.~~ Exp. 4. Another good mould has now been taken — good glossy surface — and interior surface has been oiled with sperm oil.

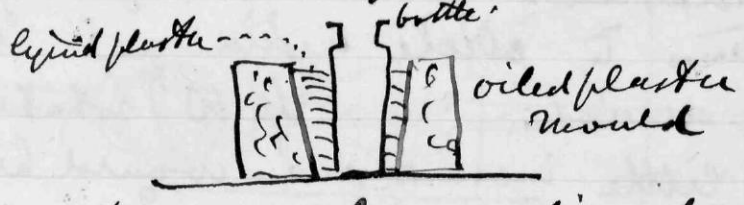
Agate cement poured in — and glass bottle pressed into mass.

Exp. 5. Agate cement mixture.



Agate cyl. with wood — closed at bottom with brass ~~tube~~ plug — shoved down into liquid ~~agate~~ agate cement in brass tube. Liquid ~~stirred~~ with steel wire — to expel air from stuff when agate cyl.

Exp. 6. Little tapering plaster mould — oiled in interior. Liquid plaster poured in — and glass bottle pressed into liquid plaster.



The plaster mould was dipped in ~~the~~ sperm oil — so as to be oiled all over.

Plaster mixture = 60 p.c. plaster + 40 p.c. water at temperature of 80° F.

N.B. Plaster Mould of Exp. 2 p. 27 is loose (9 p.m.) will leave it till tomorrow. Plaster mould of Exp. 4 p. 28 still tight (9 p.m.).

N.B. Have placed ~~three~~ small tapering plaster moulds in sperm oil — will leave them to soak in oil all night. May want to make experiments with them by and bye.

Over

1892 Jan 8 — Friday at BBh.

Two flying-machines à la Langley or Maxim hitched together and going in opposite directions — would lift weight

(W) in center — without causing W to have motion of translation. When at suitable elevation — cause both machines to fly in same direction and we have desired motion of translation. When alighting — cause the two to circle again and lower weight where desired. If (W) rotated only slowly — but little inconvenience would be caused to people carried at (W). Query — what should be diam. of circular path so as to cause very slow rotation of W — and yet a sufficient velocity in (a) & (b) to cause them to lift W. Think (a) & (b) should move at velocity not less than forty or fifty miles per hour — probably higher velocity better. Don't think ~~rotati~~ one rotation in five seconds would cause inconvenience. Certainly one rotation in ten seconds would not.

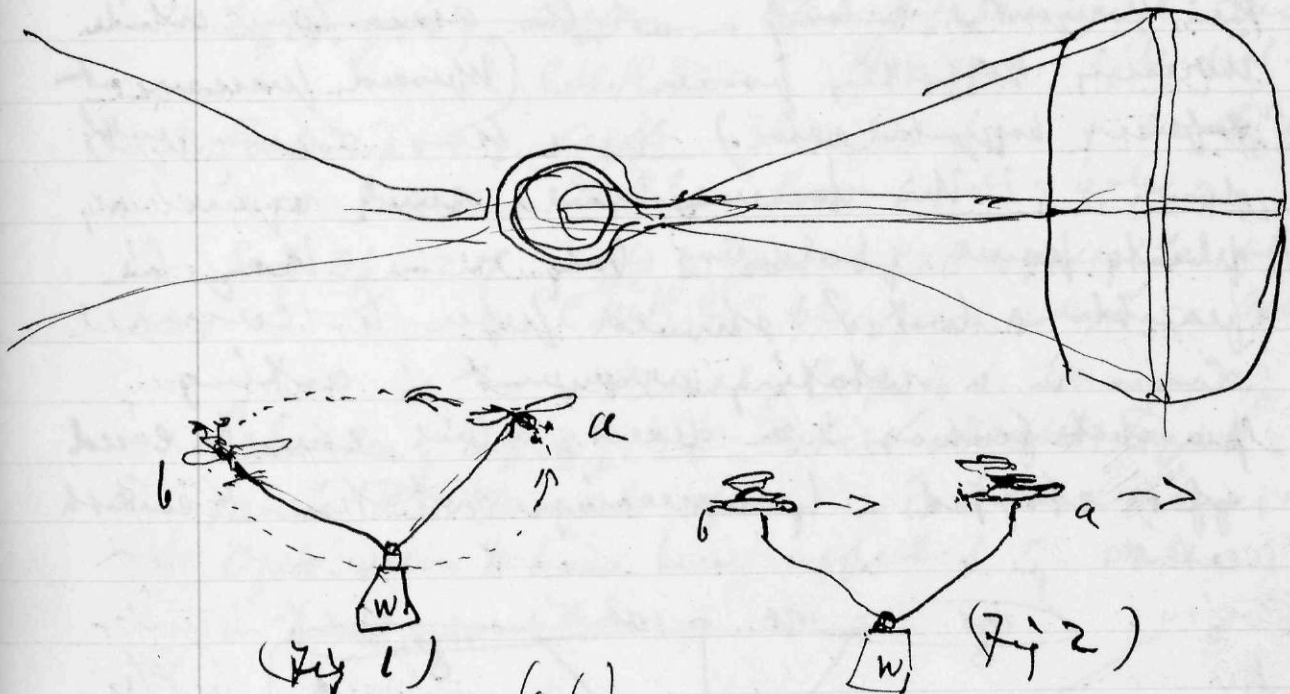
Think we could even stand for short time ~~a rotation~~, one rotation per second. Easy to arrange matters so as to neutralize rotation in center — Could for instance cause our car or room — to rotate in opposite

1892 Jan. 6 — Friday — at Wbh.

Aerial Navigation.

Assume velocity 60 miles per hour as easily calculated. That is one mile per minute — or 5280 feet.

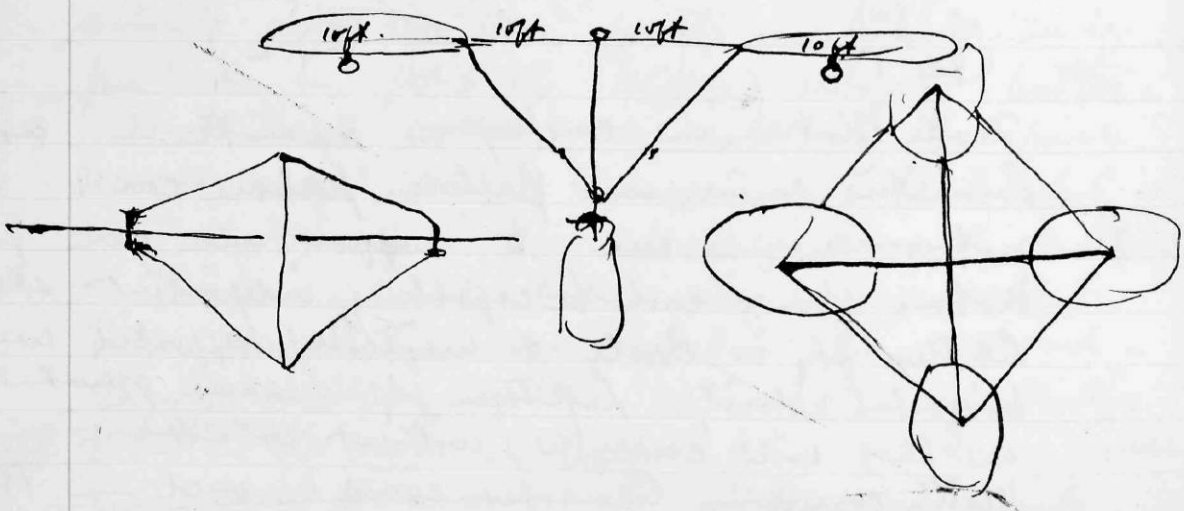
In 1 second	(a) moves 88 ft.	Travels circle 29 ft. in diam.	in 1 second
" 2 "	" 176 ft.	" " 59 ft. " "	" 2 "
" 3 "	" 264 ft.	" " 88 ft. " "	" 3 "
" 4 "	" 352	" " 117 ft. " "	" 4 "
" 5 "	" 440	" " 147 ft. " "	" 5 "
" 10 "	" 880	" " 293 ft. " "	" 10



Make Motors (a b) and cars (W) as separate — as Locomotive engine and Pullman palace car. Several motors may be used to support one car if desired. Motors should each be capable of independent steering. Let them fly in circle & weight (W) supported with horizontal velocity. Let them fly in same direction and they will carry (W) without rotation. If flexible connection like ropes could be used — the

motors (a) & (b) might be any distance apart that might be desired. If rigid connection is advisable or necessary — then distance between motors must be comparatively small.

Flexible connection feasible & think — but how about motors. Car O.K — but how could the motors ~~[illegible]~~ alight with safety. They couldn't keep circling in the air for ever — difficult to see how they are to get down without a jerk. Perhaps they might adopt the tactics of the crow and tip their wings to angle of 45° — thus retarding their horizontal velocity — ~~at the same time~~ while increasing supporting power — (upward pressure at expense of horizontal velocity) — and thus come gently down. This manoeuvre would surely require a delicate power of balancing body &c — May be feasible — but I should prefer to come down in a rotating arrangement — acting parachute fashion — descent of which can be eased off or stopped — by increasing rotation to suitable extent.



1892 Jan. 9 — Sat — at Lab.

Rabbit toe mould made Jan 4th (Exp. 2 p. 27) loose but will not come out. Forced it out. ~~That~~ Moulded record looks beautiful to naked eye — but under magnifier shows the usual "fly-speck" holes!

N.B. — ~~Will~~ Seems to make a difference whether we examine moulds by lamp-light — or by day light. ~~The~~ moulds made in Exps. 1 & 3 were examined I think chiefly by day-light — will now search them for "fly-speck" holes by lamp-light.

Results of
Exps. 1, 2, & 3 (p. 27)
made Jan. 4th, 1892.

Exp. 1. p. 27. A.G.H. — Beautiful mould — no fly-specks.
C.W.H.E. — Beautiful — splendid — no holes.

Exp. 2. p. 27 A.G.H. — Glossy surface — badly "fly-specked"
C.W.H.E. Poor — full of holes.

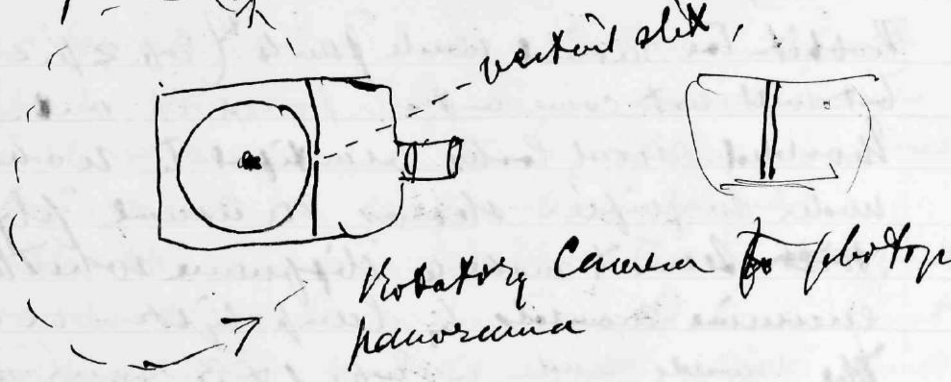
Exp. 3 p. 27 A.G.H. — Good — but not so glossy — no fly-specks
C.W.H.E. Very good indeed — no holes.

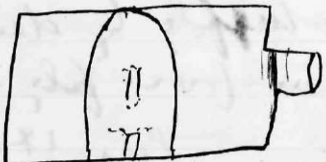
Result of Exp. 4 p. 28.

~~Cylinder~~ Cylinder of Exp. 4 p. 28 — still sticks tight. Have sawn the mould open. Extraordinary appearance. Ozok. seems to have been affected by oil. Plaster in bad condition.

O.K.

1892 Jan 9 — Sat — at Bkln





Try a cone shaped plate —  —

N.B. Plaster moulds of large tapering ozok. cylinders referred to yesterday in N.B. on page 57 — were found loose today and removed. — They look beautiful — fine glossy surface and no air-holes. — In one of them ozok. cylinder seems to have been withdrawn too soon — ~~the~~ particles of plaster remain adherent to cylinder at one end. — As these have not been noted among experiments yesterday — I will note them here in order to identify them as Exps. 1 & 2 of this date (Sat. Jan. 9th (92)

Exp. 1. ~~Large~~ Plaster mould ~~taken~~ made yesterday from ~~Ex~~ full sized tapering ozokerite cylinder + loosened today (see N.B. above). Beautiful mould.

Exp. 2. Plaster mould made yesterday — referred to in N.B. above. Mould good — but some plaster particles at one end remain adherent to ozok. cylinder.

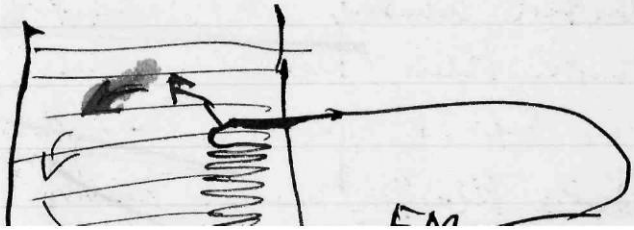
Exp. 3. Made record on another full-sized ozok. tapering cylinder — & Mr Ellis made plaster mould

1882 Jan 1 — York — at Bible

tonight — after the Entertainments at the Warehouse — Hope it will be loose and free by Monday morning.

Crowded meeting — workpeople & friends at warehouse this evening — W. McClung gave a Magic Lantern Entertainment — I read and sang — and showed some Trees — M. Macdonald(?) played the bag-pipes — and then some young men sang Gaelic Songs.

Before meeting — W. Blanchard took supper with us. Told him of Electric Heating Idea. Old to me — but new to him as to W. Ellis. Somehow I never appreciated importance of idea as I do tonight — Will note it here — and shall consider really Entry — should it turn out to be new and original with me. Too simple and obvious I fear — not to have occurred to other minds.



1892 Jan. 9 — Sat. at Ohl.

Could heat boxes in this way.
Portable radiators — put where
wanted — Oil can be heated
for above ~~use~~ boiling point & water —
Have Electrical Oil-stove for cooking.
Tea urns — copper ones — Hot water urns —
for tea-table would same way.
Foot warmers — & under bed-pans
operated same way. Others heated
for heating &
Will try to elaborate tomorrow.
Have written long letter to Mabel —
tired & must go to bed —
No — am in bed now — &
have been for two or three hours.
Must go to Sleep.

Worked at Ohl
Jan. 9th 1892
Ags

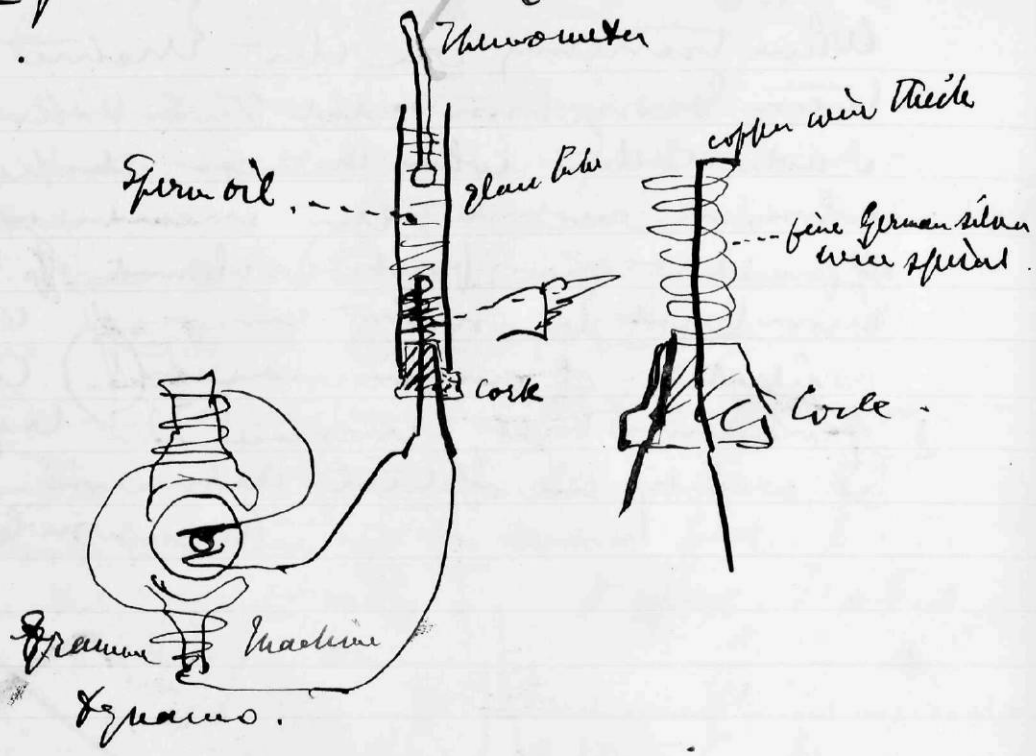
1892 January 10th Berne Borough Lodge

When travelling on the Electric cars between Georgetown and Twin Oaks last night I noticed that when the cars struck violently when in motion the incandescent-lights affected to emit from a bowl of light and more light be in the car. — Every violent oscillation of one incandescent (1) light really emit more light, increase the light, or is it merely an optical delusion —

Arthur Wuhrman

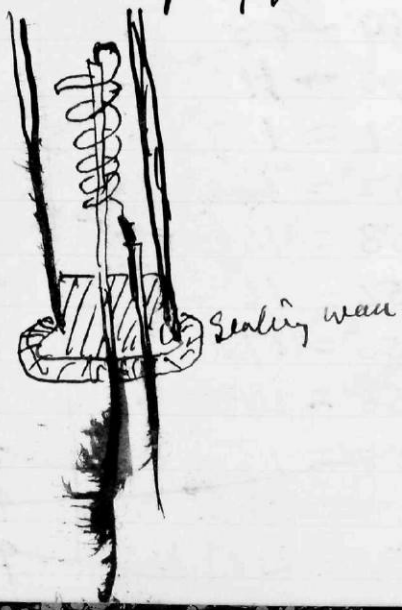
1892 Jan - 11th. Rowland — cat 1856.

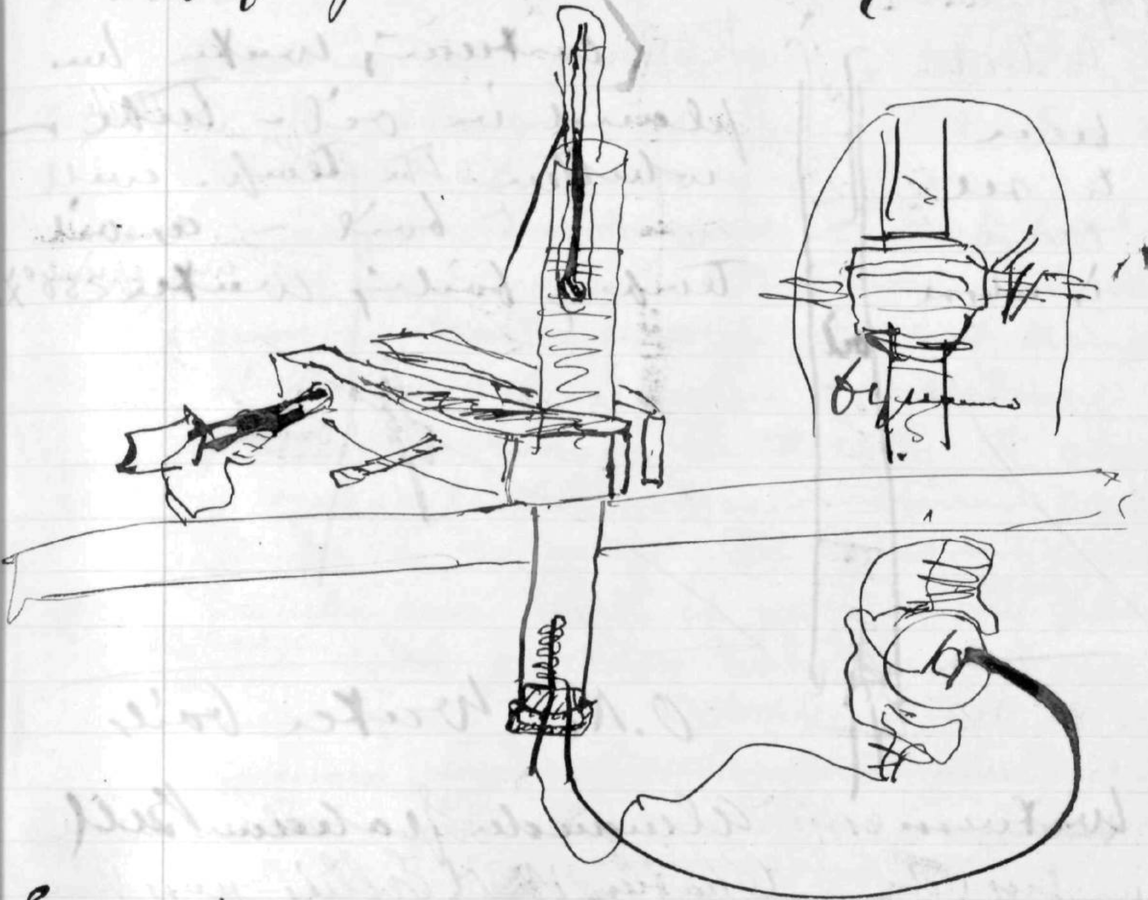
Exp. 1.



~~Fine spiral~~ Spiral of fine german silver wire in glass tube. Connecting copper wires pass through cork at bottom. Tube filled with Sperm oil (which appears to be a non-conductor of electricity). Thermometer in upper part of glass tube.

Cork to be sealed with sealing-wax. Central wire insulated with cotton ~~paper~~ covering —





Exp. 1. Present – Mr. Martin, Mr. McInnis, Mr. John McKillop
Mr. Ellis & self

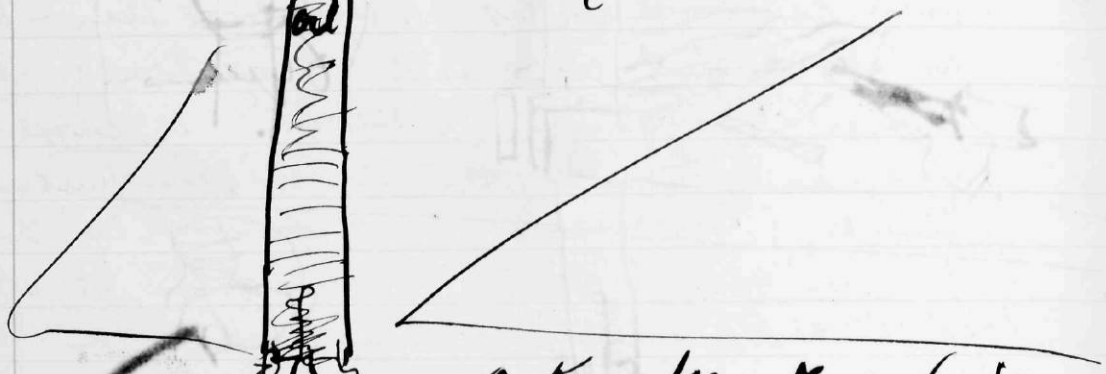
8.47 p.m. Temp. of oil = 61° F.
8.48 p.m. Dynamo started. Circulation
(Time) starting in oil – Temp. rising fast.

Time	Temp.	Time	Temp.	Time	Temp.
8.49	88° F.	9.00 p.m.	220° F.	9.11	253
8.50	110° F.	9.01	227° F.	9.12	254
8.51	127° F.	9.02	229° F.	9.13	255
8.52	138° F.	9.03	234° F.	9.14	25[illegible]
8.53	155° F.	9.04	238° F.	9.15	255
8.54	168° F.	9.05	240° F.	9.16	255
8.55	178° F.	9.06	242	9.17	256
8.56	189° F.	9.07	245	9.18	256
8.57	199° F.	9.08	248	9.19	256
8.58	206° F.	9.09	250	9.20	256
8.59	213° F.	9.10	251	Ending Exp. 1.	

1892 Jan. 11th — Monday — at B. Bk.

Exp. 3 — A test — been to see cause & above

tube containing water has placed in oil — tube & whether the temp. will water & boil — as oil temp ? boiling water 258° F.



O.K. Water boils

Witnesses. Alexander Graham Bell
Charles W. Ellis
Angus McInnis
Tasius H. Martin
John McKillop

Laboratory will now close for the season —

Ags

1892 Jan. 11 — Morning — at BBL.

Labelling and putting away models &c —

Result Exp. 2 p. 58 — Mould ~~cast in Exp~~ made Jan. 8 — Exp. 2 p. 58 still kept. How ever it open.

Surface looks good — but full of holes.

N.B. — We now recognize that these little holes that have so bothered us — are not air-holes at all — but are caused by fracture of the plaster elevations of the mould. A close examination of opak-cylinder — reveals minute particles of plaster in the grooves of the mould — evidently the particles have been torn off from the plaster mould — each little particle being retained on the plaster mould by a little depression — hole — or fly-speck appearance ~~on surface of plaster mould~~ which we have hitherto mistaken for "air-holes".

Result Exp. 5 p. 59 — Opak-cylinder remains kept in agate cement mould made Jan. 8 Exp. 5 p. 59. Have stripped opak-cylinder of its paper band — and then with blade & perhaps easily removed opak-shell.

Result: Agate cement surface — glossy surface — excepting parts where mould & stripped by adhesion to opak. Holes also observed here there in plaster — also one — if not two — holes undoubtedly formed by bubbles of air.

Noted Jan. 11th 1892 at BBL

AGM

1892 Jan. 12 — Tuesday — at Beinn Bhreagh

I find that a large number of important experiments made after the 27th of October 1891 (see p. 222) have not been noted. Cannot recall them all now. Reason is — my time was so taken up with the revision and re-writing of my lectures upon Flight before the A.A.A.S. that I had no time for notes.

W. Ellis left for Boston Nov. 12th 1891 — so all the experiments must have been made between the 27th of Oct. & the 12th of November.

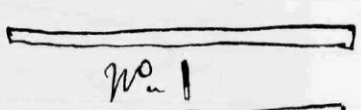
Will note what I find here — for presentation in museum.

The solid brass stock for which we had waited so long — didn't want for it — but "longed" for so long! — arrived in Baddeck — somewhere about the 27th of Oct. All experiments were at once suspended & W. Ellis went to work upon manufacturing — & tapering brass cylinders — which Mrs Bell & I went to work upon Lectures.

Tapering Brass Cylinder No. 1

W. Ellis made two cylinders.

Brass Cylinder No. 1. Length (AB) A 6 1/8 inches.



External diam. of A = 1 5/8 External diam. of B = 1 5/8
Internal " A = 1 3/16 Internal diam. of B = 1 4/16

This will be put in museum here with brass caps

made a few days ago — (about a week ago Mr Ellis says).

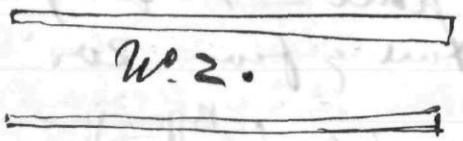
Brass caps! — 

for cylinders.
Ext. diam. = 2 inches. Thickness (a c) 1/4 inch.
Diam. across (d e) = 1 5/8 inches.

Tapping Brass Cylinder No 2

Two of these alike — used on either end.

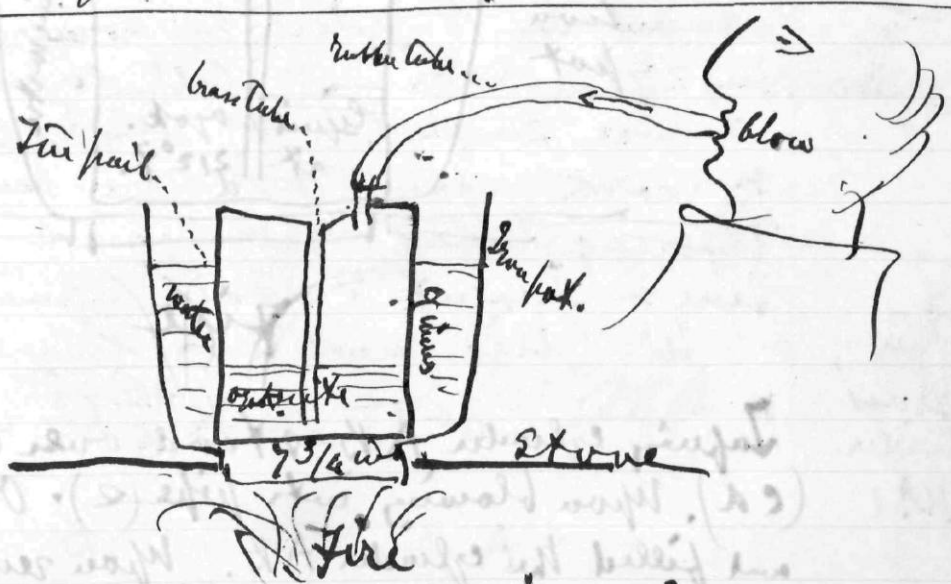
This cylinder will be taken to Washington to Volta Laboratory — as well to continue experiments with it.



	A end	B end
Length A B = 6 3/8 inch	Ext. diam 1 5/8 inch	1 5/8 inch
	Int. diam 1 5/16 "	1 4/16

This cylinder will be taken away with us to Washington — with two half-pint bottle-cork caps.

Apparatus for making oxyh. cylinders from brass cylinders



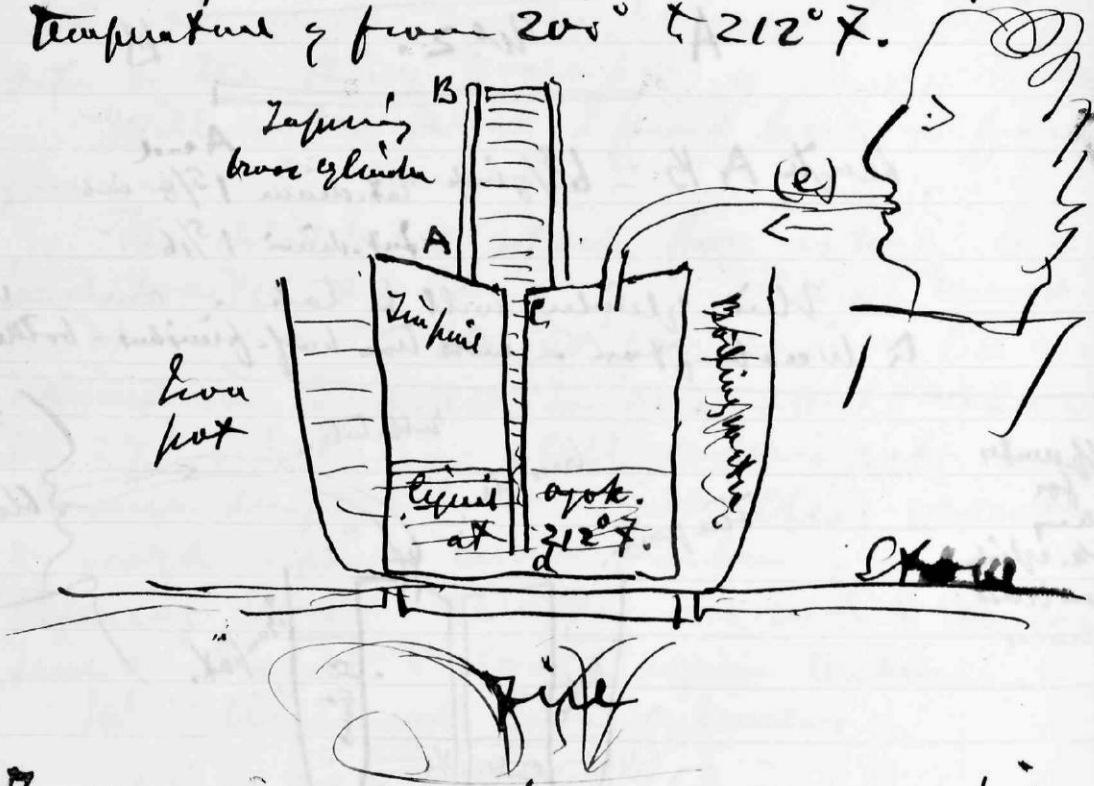
Above apparatus was made immediately after completion of tapping brass cylinders No. 1 & No 2. shortly after Oct. 27th 1891. Many experiments were

1892 Jan. 12 — [illegible] at [illegible].

made with it between that time and Nov. 12th when Mr Ellis left for Boston — room & which have been worked — as they came — as Mr Ellis says — "during the lecture period"

Apparatus worked well. Mode & operation as follows.

Iron pot put on stove with hot water in it — water kept boiling. This caused melting & ozokerite in tin pail — keeping it at a uniform temperature of from 200° to 212° F.



Tapering cylinder AB stood over central pipe (cd). Upon blowing into pipe (c). Ozokerite rose and filled the cylinder AB. Upon removing mouth from pipe (c). Ozok. in cylinder flowed back into reservoir below leaving a thin coating upon interior surface of cylinder AB.

When right coating not thick enough — we could give a second — Thus to coating by simply pouring into tube(s).

Top of pail made concave so that over-flow to — should run back into reservoir below.

Apparatus worked very satisfactorily Will now put away in museum.

Apparatus for Taking Curls, —

Levelling device also made — same pattern — Oct. 27 & Nov. 12th 1891 — used Nov. 12th 91 in ~~trouble spring~~ taking height of spring above level of tube.

Forgot height just now — but notes where made of experiment at time on loose sheet of paper.

The Steamer Marquette has arrived at our wharf to take us to Grand Rapids. on our way to Washington and I must stop.

Good by to Benn Pitman.

Noted Jan. 12th. 1892. AGB

Jan 12 1892 E.C.H.E.

1892 May 26 — Thursday — at B'Bk.

Left Boston last Sat. (May 21) at noon in Steamer Halifax for Halifax with M. E. D. A.M.C. Miss Clarke, and Rose (the maid). Reached Halifax Monday morning (May 23) after stormy passage.

Drove to depot about leaving rest and baggage to follow next day — just caught train. Reached Beinn Bhreagh Wednesday night May 23. Spent night on top of Beinn Bhreagh in shepherd's house..

M., E., D., A.M.C., Miss Clarke & Rose — and also Susie McCurdy — reached Beinn Bhreagh Tuesday night (May 24th). Steamer landed party at own wharf. W. McC — and Susie went to Baddeck from here Tuesday night (May 24th) in steamer.

Wed. May 25 — all quietly at home. Elsie in doors. Mabel & Miss Clarke drove round shore road. Daisy spent day on top of mountain with me.

Thursday (May 26) today — spent day on mountain. Elsie & Daisy had lessons from Miss Clarke. Mabel spent morning driving over place with W. McLennis — marking trees &c — for destruction & trimming. In evening Mabel went into Baddeck to attend Ladies' Club. Met her half way both way home — dark road — horse wanted more light —

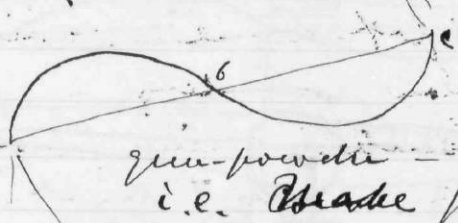
Thought of

Have incandescent lamps with suitable reflector attached to forehead of horse to illuminate road —

1892 May 28th Saturday ... at Biskra.

Mr. Ellis arrived in Baddeck last night. Stayed at Telegraph house. Here this morning. Brought with him books for flying machine experiments.

Night. Fill tube a b c

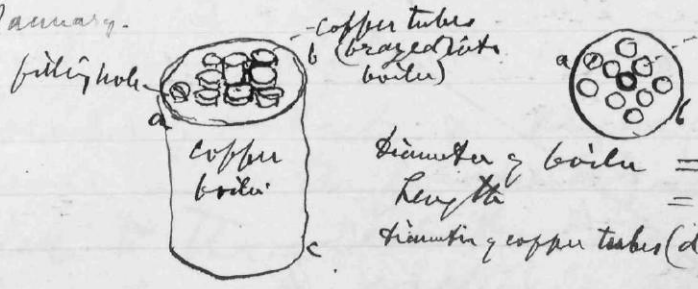


with gun-powder — arranged as in a rocket. i.e. Make pipe a b c a rocket. Perhaps Solid plug at b would be best so as to make each arm (b a)(b c) into separate rocket. Think gunpowder in rocket mixture is mixed with a Neutral powder like earth to make it burn more slowly.

Night. Fill tube with mixture of Charcoal & Potash and sugar — and touch off with sulphuric acid.

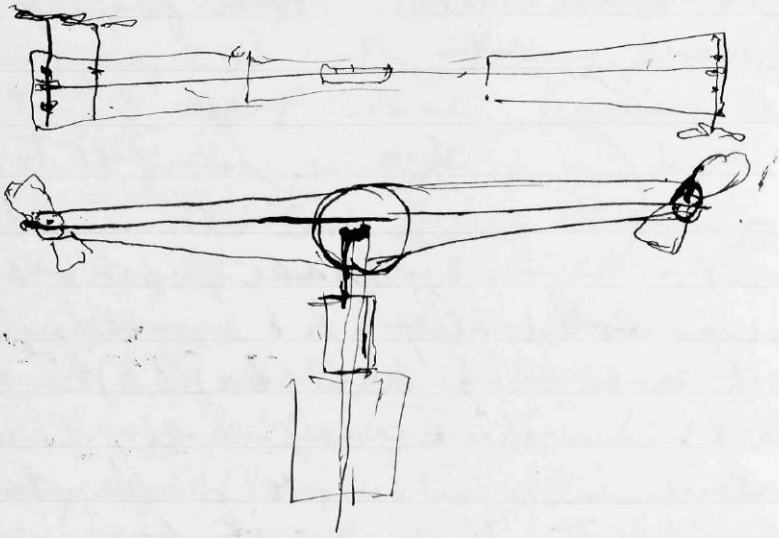
Night. Generate carbonic acid in boiler by chemical mixture as in Chemical Fire-engine (Babcock Extinguisher).

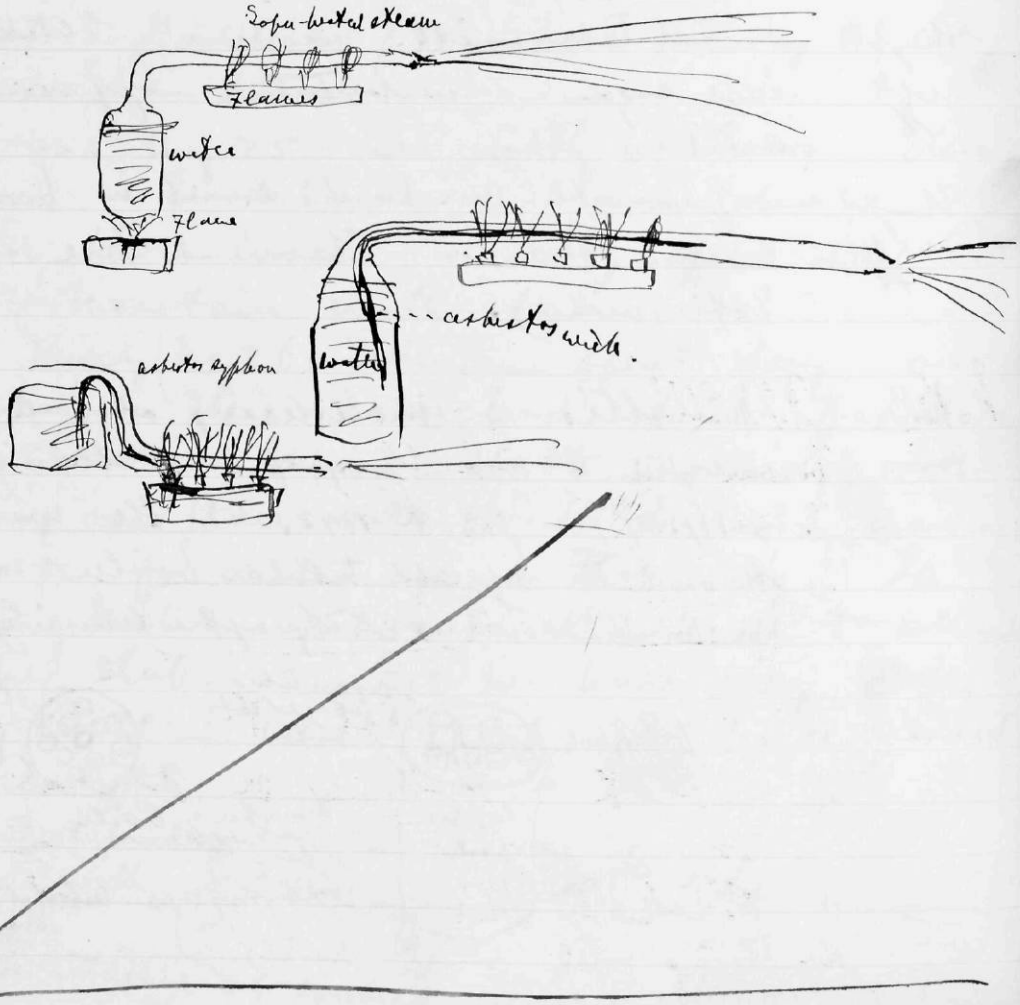
N.B. Mr. Ellis is unsoldering old wing-pulley made Jan. 4th 1892 — (p. 29) from old boiler used in Exp. 1 (p. 57) on Jan. 8th 1892. He will solder it on to the upright tubular boiler made for me in Boston shortly after leaving Berne Biskra in January.



1892 May 29 — Sunday — at Bbln.

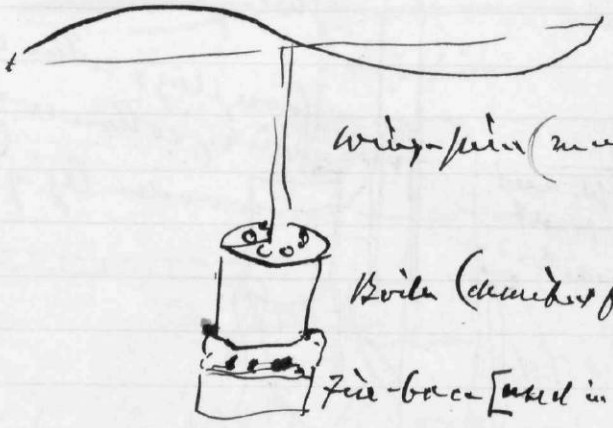
H. Mackeen & his son George Mackeen BSc. spent evening with us.





1892 May 30th. — Monday — at Ellis.

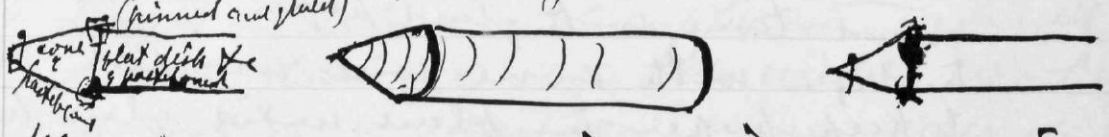
Just going to try boiler attached to foot of p. 77 with wing-piece (made Jan. 4th. 1892 p. 29)



Expt. fire-box = 123 grammes
alcohol = 48 grammes (exhausted over night)

One stone of alcohol is exhausted. Two on trying experiment — as 48 grammes is little more than volume is required to moisten the wicks.

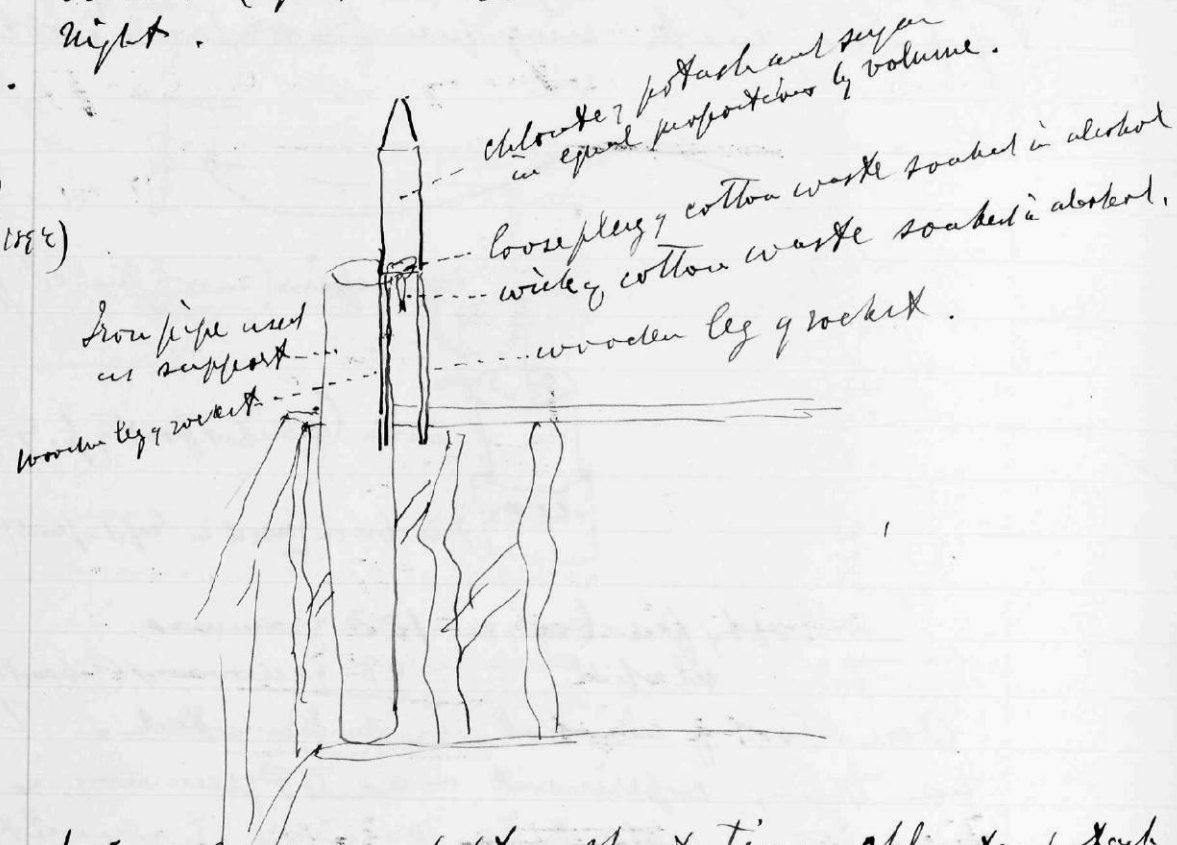
H.B. Mr Ellis has fastened a conical end on to an old gramophone cylinder — intending to make a rocket, if.



We will now fill it with a mixture of Chlorate of Potash & sugar (half-in-bulk & volume — both powdered) — Put a stick to the rocket — and touch the thing off with sulphuric acid.

1892 May 31 – Tuesday – at Bath.
Chlorate & potash rocket Tried last night.

Exp. 1.
(Made yesterday May 30th 1892)



Wick lighted – after short time chlorate & potash mixture ignited – but rocket did not rise.

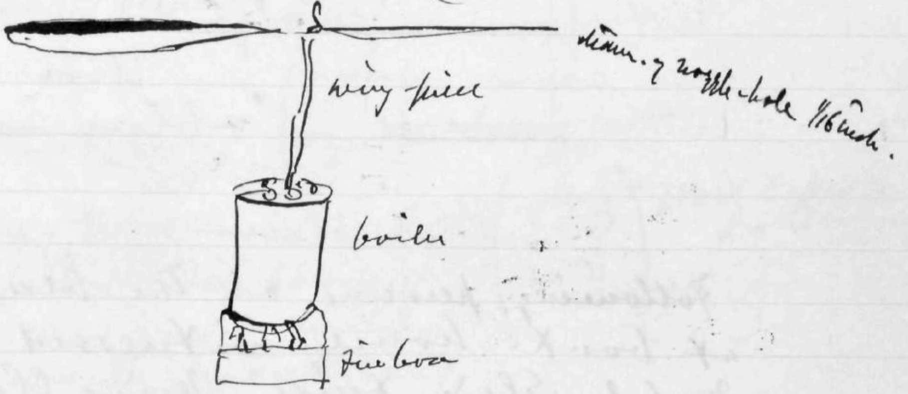
N.B. W. Ellis made three rocket tubes this morning of pasteboard – glued into a tube as shown here  Whole tube was then wrapped round twice with glued paper – and left to dry – with some wire wrapped round to keep paper in place until glue had set. Dimensions:–

Length 6 inches
Diameter 55/100 int. diam.

Three rocket tubes made.

1892 May 31 — Tuesday — at B.Bh.

Exp. 2. Mr Ellis bought some alcohol in town today so we can now resume the experiments we proposed to try yesterday (see top of p. 77).



Fire-box and alcohol	=	377 grammes.
Wing-piece + boiler (empty)	=	4049 grammes.
water	=	852 grammes.
Total weight	=	5278 grammes.

Fire lighted ~~3.07 p.m.~~ 3.10 p.m.

Within 4 minutes it commenced to rotate well giving 48 rotations per minute and increasing rapidly. Became somewhat nervous in case of accident so squirted fire-hose over thing, and stopped it. Will arrange it out-of-doors — where an explosion will do no damage. We will watch it out of window or from safe distance and let it rip! As the boiler is supposed to be capable of standing 600 lbs pressure to the square inch — it is probable that something would happen if boiler burst. Safest to keep at a distance.

1892 May 31 —

Exp. 3 Fire it out & down ——

Fire lighted at 3.40

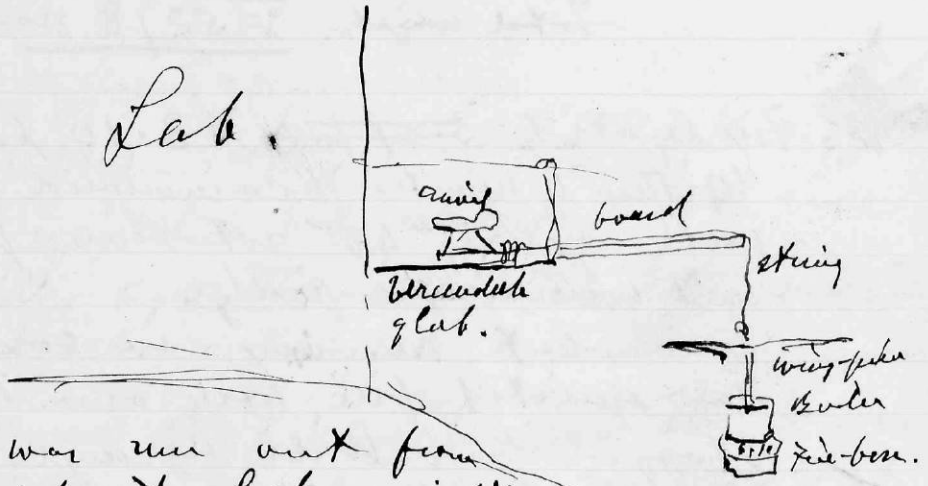
Started 3.50

Not pressure enough — Air cold and some wind — thus cooling boiler outside — & blowing flame away.

Blew flame out at 3.56 p.m.

Following persons on the beach down at boat house witnessed the failure! Merbel, Elsie Fairy, Miss Clarke Mr. McCurdy Sam McCurdy, George McCurdy, Douglas McCurdy.

In the foregoing experiment (Exp 3) —

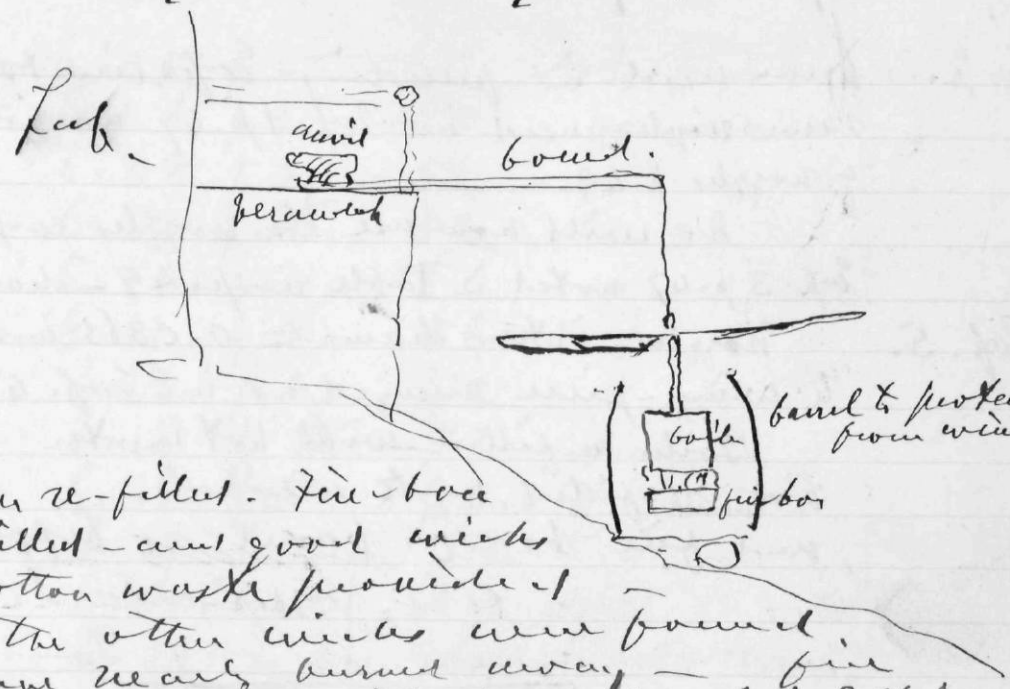


A board was run out from the verandah of the Lab. weighted at one end with an anvil.

Flying machine suspended between other end of board. Air outside pretty cold — and slight wind blew flame to one side. Will repeat experiment outside with boiler and fire-box inside a barrel.

1892 May 31 – Sunday – at Blk.

Eof. 4.



Boiler re-filled. Fire-box re-filled – and good wicks & cotton waste provided – (as the other wicks were found to have nearly burned away – fire was going out & steam when Mr Ellis blew out flame.

Fire lighted at 4.28 p.m.
4.30 p.m.

at 4.33 p.m. 20 wt. p. min.
" 4.35 p.m. 32 wt. p. "
" 4.37 p.m. 40 " " " } Nozzle moved at rate of about 8 miles per hour.
" 4.40 p.m. 40 " " " }

Light blower ~~out~~ at 4.45 p.m. Present as before – Mabel, Elsie Daisy, Lucie, George, Douglas, Miss Clarke and W. McCurdy.

N.B. The nozzles seem to afford so free a blast that pressure in boiler not great. Will try a smaller orifice. Int. diam. of nozzles used = 0.062 of inch. ~~Mr~~ Mr. Ellis will now plug up nozzles with lead and drill them out again with a drill = 0.03 of an inch. Just found the nozzles used in former experiments – in a small bottle in ~~museum~~ Lab. Museum. We

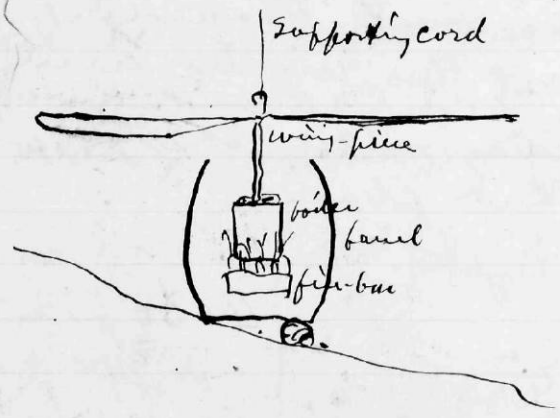
Boyz Mey 31 — Tuesday — at Bible

boiler used in preceding Experiments (2, 3, & 4) the same nozzles used in Exp. 1 p. 47 as noted in table of nozzles p. 49.

We will now use the nozzles employed in Exp. 3 p. 47 noted in Table on p. 49 — diam. = 0.0365 inch,

Exp. 5. Nozzles intern. diam. = 0.0365 inch — fitted to wing-piece arranged as in Exp. 4.

Boiler re-filled with hot water — Fire-box re-filled with alcohol — Boiler and fire-box in barrel as before in (Exp. 4 p. 84)



Fire lighted at 5.47 p.m.
Steam blows 5.48 Steam out of casing
6.50 Down out of pipe

5.51 p.m.	28 wt.	p. inch.	Steam from both — but one plugged up.
5.53 p.m.	32 wt.		
5.54 p.m.	44 "	"	
5.55 p.m.	52 "	"	
5.56 "	52 "	"	
5.58 "	60 "	"	
5.59 "	56 "	"	
6.00 "	56 "	"	
6.01 "	64 "	"	
6.03 "	60 "	"	
6.04 "	60 "	"	

1892 May 31 — Tuesday — at BBk

Exp. 5 cont.

6.05	p.m.	60	revs per min.
6.06	p.m.	60	" " "
6.08	p.m.	52	" " "
6.09	p.m.	52	" " "
6.10	p.m.	60	" " "
6.11	p.m.	56	" " "
6.13	p.m.	52	" " "
6.15	p.m.	52	" " "
6.16	p.m.	40	" " "
6.17	p.m.	32	" " "
6.18	" "	18	" " "
6.19	" .	Stopped rotation.	

The above experiment has been made with steam issuing chiefly from one nozzle. The other evidently plugged up.

The alcohol has been out — & wicks have burned down. Will now see if any water is left in boiler.

Yes — about ½ a cupful of water left.

Now to examine nozzles.

One nozzle plugged with a little Metallic chip. ~~Still~~ Still further plugged. Cannot see through hole — although some of the particles have been removed.

Yes — a small piece of old rubber (plugging old rubber washer) completely plugged orifice.

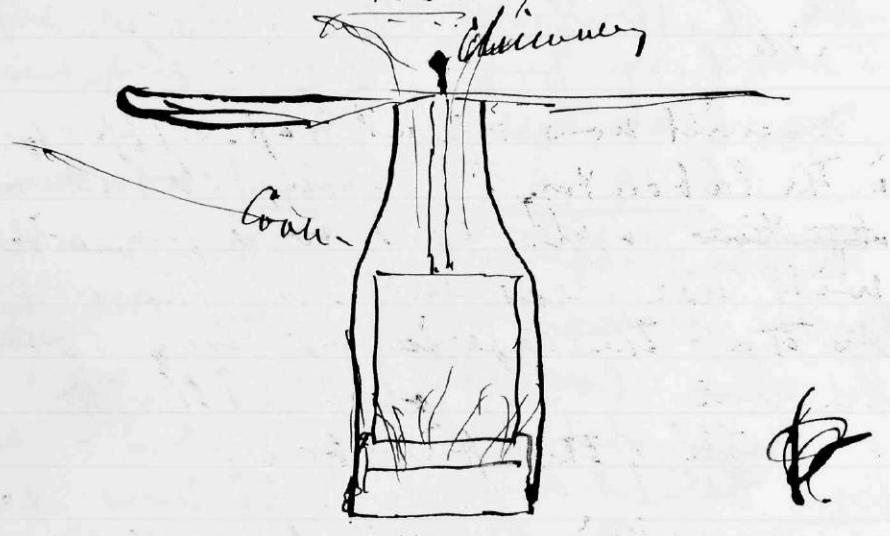
Must repeat experiment with both holes free.

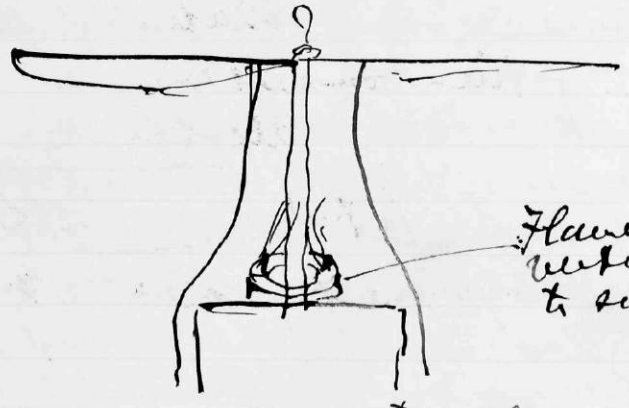
Witness — Asst & W. Ellis.

1892 May 31 — Tuesday — at W.H.

N.B. In Experiment 5 (pp 85-86) machine made 60 rot. per minute with one nozzle practically completely stopped up. Nozzle moved once round circular path 18 feet in one second.

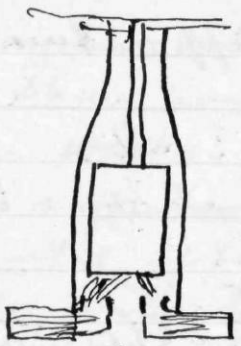
1060 ft per second
1080 ft per min.
60
5280) 64800 (12 miles per hour.
528
1200
1155

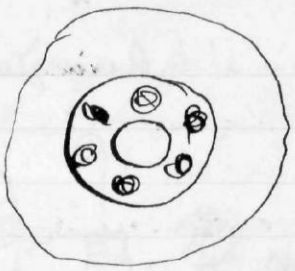




N.B. Mr. Ellis says that the flame with from lower alcohol lamp will fill flame above — and other flame use necessary

Thread off 7





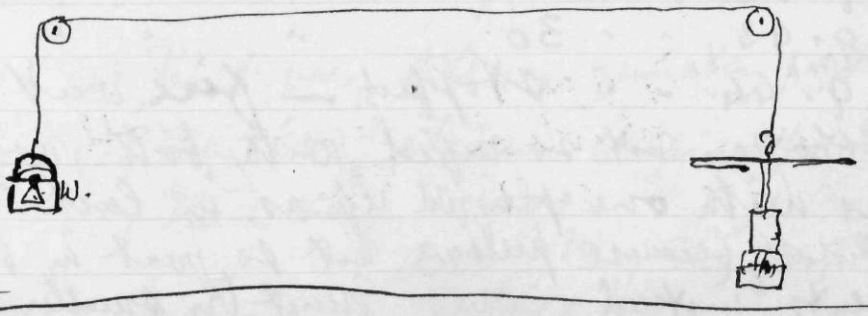
alcohol reservoir what external air can cool it. Air hole in center of alcohol reservoir. Circle of wicks.

Exp. 6. 24

We will now repeat Exp. 5 (pp 84-85) indoors in the laboratory — having cleaned out the ~~opening~~ nozzle that was plugged. We will use less alcohol than before so that the experiment may come to an end before long without necessity of wetting the fire-box.

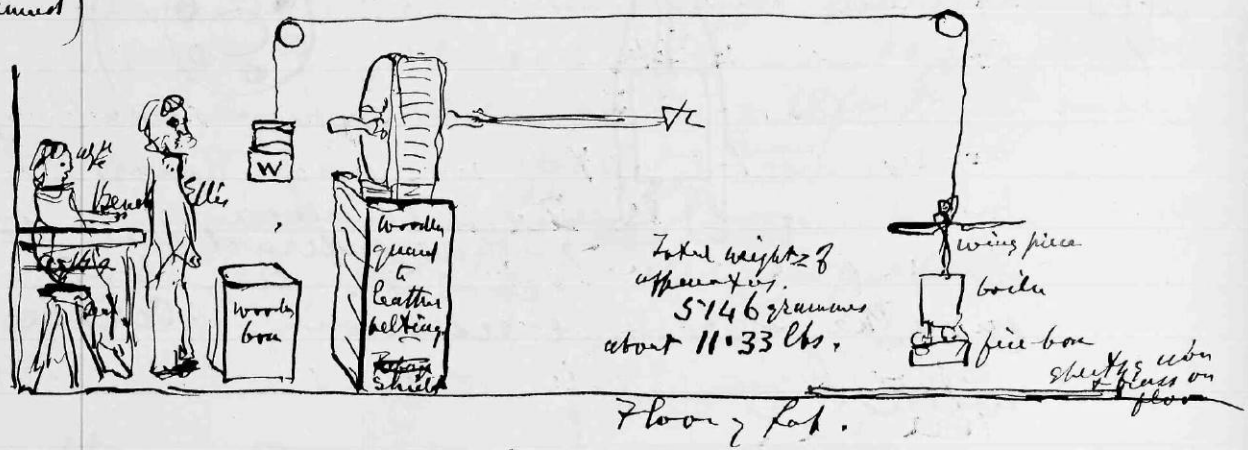
Wing piece & bottle	=	4049 grammes
Water	=	85·2 grammes
Fire-box and wicks	=	123 grammes
Alcohol	=	122 grammes
Total	=	5·146 grammes

Arrangement of Experiment 6



1892 May 31 — Tuesday — at Bibb.

Exp. 6 (Arrangement of apparatus.)
(continued)



9.22 p.m. Fire lighted.
9.23 p.m. Steam steams — burning — both nozzles free.
9.25 p.m. 36 rotations per min.
9.26 p.m. 42 " " "
9.27 p.m. 50 " " "
9.28 p.m. 50 " " "
9.29 p.m. 52 " " "
9.30 p.m. 50 " " "
9.32 p.m. 52 " " "
9.33 p.m. 50 " " "
9.35 p.m. 50 " " "
9.37 " 52 " " "
9.38 " " 50 " " "
9.40 " " 50 " " "
9.41 " " 44 " " "
9.42 " " 40 " " "
9.43 " " 30 " " "
9.44 " " Stopped — fire out.

N.B. Rotation not so rapid with both nozzles free as with one played up as in last experiment. Probably because pressure not so great in boiler — two vents instead of one. Must try smaller nozzles.

N.B. Mr. Ellis suggests making a larger fire-box — Ellis. no deeper than now — but carrying at least four more tubes.

He also suggests not trying smaller nozzles until after we have completed experiments with the larger nozzles — and bigger fire — with jacket on boiler — as the smaller nozzles may cause explosions of boiler — and then where are we?

Off. Think Mr. Ellis is right — don't use any smaller nozzles than the present ones ~~suggesting~~ as a final experiment.

Plan & Expts. First Plan. Make as much steam as possible — using our largest nozzles. Increase fire — cut off radiation from boiler — protect arrangement from cold air — . Use nozzles of 0.06 int. diam. — and don't reduce size till we have obtained the maximum steam possible from arrangement ~~same~~ — and greatest rotation with these nozzles. Then try reducing nozzles. Try present nozzles 0.0365 inch int. diam — and after that smaller diam. if desirable.

(1) First vary steam-generating part
(2) Then vary steam-escaping part
(3) Then vary wings.

Aft May 31st 1892
H. C. V. H. E.

1892 May 31 – Tuesday – at WB&A

Thought of Bath-Tut notes. Very doubtful whether extremity of wing is best location for jet of steam. As rapid water in the jet turns away from air against which it plays. If then passes against air with less force than if wing was steel – & thus reduces pressure in boiler.

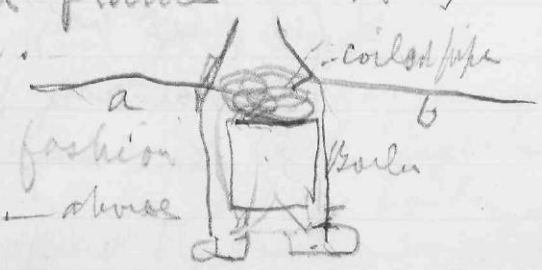
Inclined to think it should act at some intermediate point at ~~a~~ mechanical disadvantage.

Experiments made to test this point, some inconclusive – as boiler burst during second experiment before a constant rotation had been established. [See Exps 1 & 2 of Jan. 7th 1892 ~~H 50, 52~~ 51 & 52]. Perhaps good plan to test point with boiler we now have. The same pipe used in former experiments [H 52] could be attached to boiler.

May 31 eve

Increase surface of pipe filled with steam (not water) which is in contact with flame – so as to superheat steam.

Let pipes a & b have several turns spiral fashion inside furnace box – above boiler.



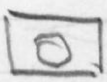
1892 May 31 — Tuesday — at BB

Ungbt off — Still better to make chimneys of both arms.

Here the whole tube filled with steam will be subjected to action of hot air &c.

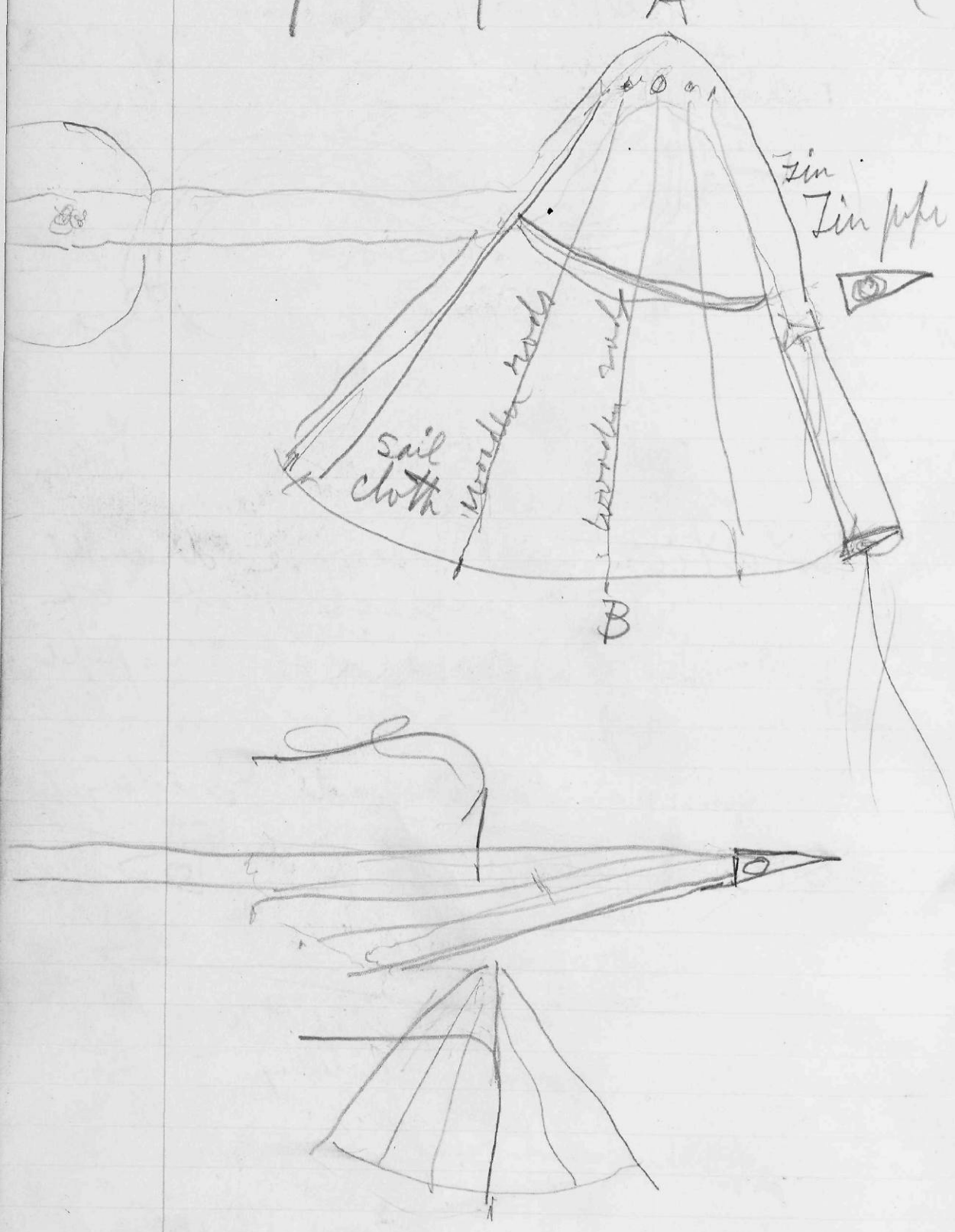
Rotation will increase draught in chimneys & increase heat of fire. Not bad idea — a pipe within a pipe.

Ungbt — Chimneys could be made rectangular

 or wedge shaped 

Good idea.

1892 May 31 — at Bldg



1892 June 2 — Thursday — at Kew

Screw which plugs hole used for filling boiler does not fit tightly — thread worn.

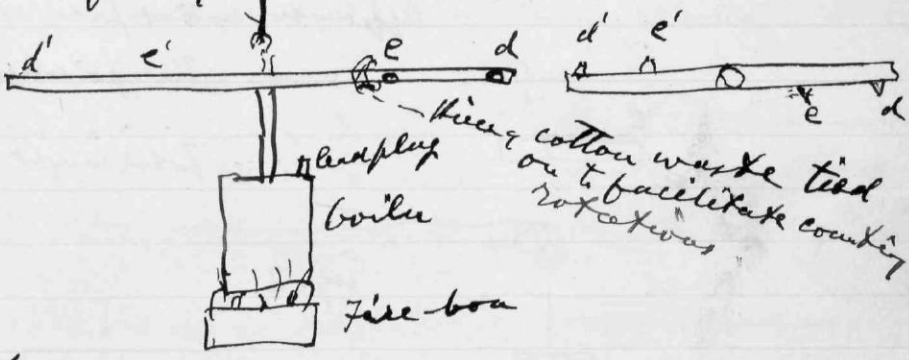
Mr. Ellis is plugging hole with fine-pluy. Plug will not hold — copper of top of boiler so thin that he cannot get thread enough to hold. He is now tapping out hole a little larger — making new thread in it.

~~He now making a brass screw to fit new hole in top of boiler — (on pattern same hole as before but enlarged).~~

He has screwed in a plug of lead to try.

used apparatus now ready

Exp. 1. Nozzles dd' free — and nozzles ee' plugged. Beam. 7 orifices 7 nozzles = 0.05 inch.



Fire lighted at 10.01 p.m. — Steam shows at 10.04

	10.05 p.m.	30	rotations per min.
	10.06 p.m.	32	" " "
(1)	10.07 p.m.	32	" " "
(2)	10.08 p.m.	34	" " "
(3)	10.09 p.m.	34	" " "
(4)	10.10 "	34	" " "
(5)	10.11 "	32	" " "
(6)	10.12 "	32	" " "
(7)	10.13 "	34	" " "
(8)	10.14 "	30	" " "
(9)	10.15 p.m.	34	rotations per min.
(10)	10.16 p.m.	34	" " "

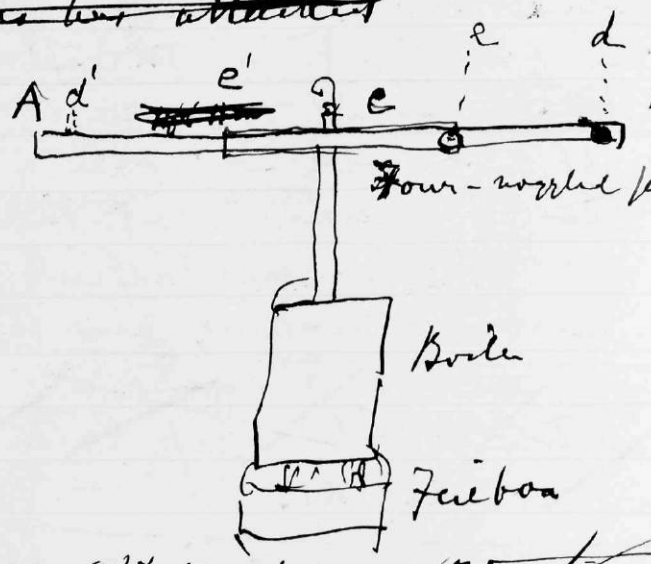
Blew the flame out.

Boiler + water weighs = 4619
Fire box and alcohol = 170

Boiler + water before exp. = 5051
" " after " = 4619
water evaporated = 432

Fire-box + alcohol before exp. 250
after exp. 170
Alcohol consumed 80

1892 June 2 — Thursday — at Bibb

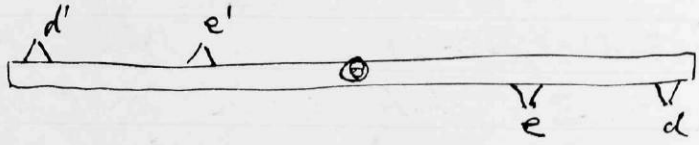


Tube A B = 5 ft 11 inches —

Extern. diam. at A = 0.61 inches — Extern. diam at B = 0.61 inch
Extern. diam at C = 0.68 inches.

Nozzles: diam. = 0.05 inch.

Distance of nozzle d from centre of tube = 2 ft 11 inches
" " " d' " " " = 2 ft 11 inches
" " " e " " " = 17 inches
" " " e' " " " = 17 inches



Boiler & Tube A B — empty = 4114 grammes.
Water = 937 "
Fire-box & wicks = 123 "
Alcohol = 127 "

Before experiment Total weight = 5301 grammes

1892 June 2 — Thursday — at Kew

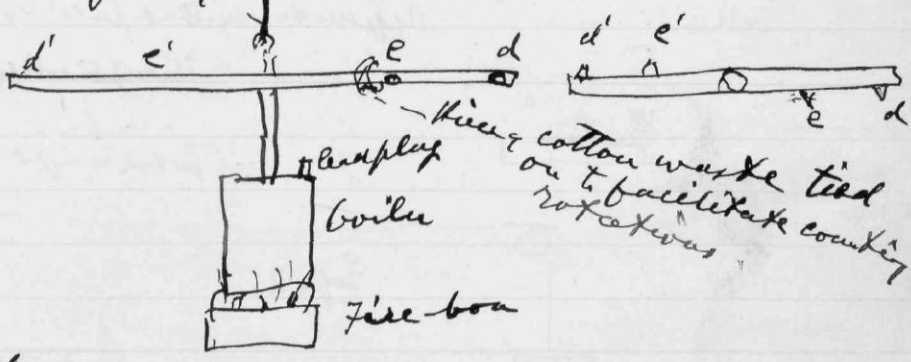
Screw which plugs hole used for filling boiler does not fit tightly — thread worn.

Mr. Ellis is plugging hole with fine-play. Plug will not hold — copper of top of boiler so thin that he cannot get thread enough to hold. He is now tapping out hole a little larger — making new thread in it.

~~He now making a brass bottle to fit new hole in top of boiler — (on cotton same kind as before but enlarged).~~

He has screwed in a plug of lead to try. Has used apparatus now ready.

Exp. 1. Nozzles d d' free — and nozzles e e' plugged. Steam of orifices of nozzles = 0.05 inch.



Fire lighted at 10.01 p.m. — Steam shows at 10.04

	10.05 p.m.	30	rotations per min.
	10.06 p.m.	32	" " "
(1)	10.07 p.m.	32	" " "
(2)	10.08 p.m.	34	" " "
(3)	10.09 p.m.	34	" " "
(4)	10.10 "	34	" " "
(5)	10.11 "	32	" " "
(6)	10.12 "	32	" " "
(7)	10.13 "	34	" " "
(8)	10.14 "	30	" " "
(9)	10.15 p.m.	34	rotations per min.
(10)	10.16 p.m.	34	" " "

Blew the flame out.

Boiler + water weighs = 4619

Fire box and alcohol = 170

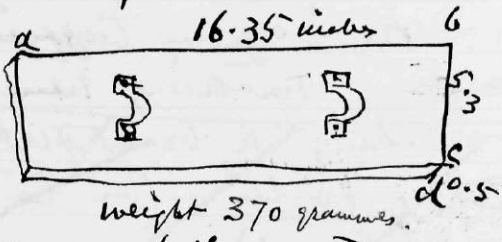
Boiler + water before exp. =	5051
" " after " =	4619
water evaporated =	432
Fire-box + alcohol before exp.	250
after exp.	170
Alcohol evaporated	80

1892 June 2 — Thursday — at Ushaw.

Exp. 2.

Boiler + water = 5051 grammes
Fire-box + alcohol = 250 "
Total 5301 "

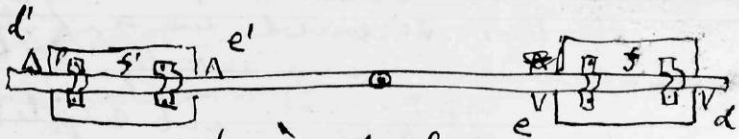
Two wooden paddles attached.



ab = 16.35 inches
bc = 5.3 "
cd = 0.5 "

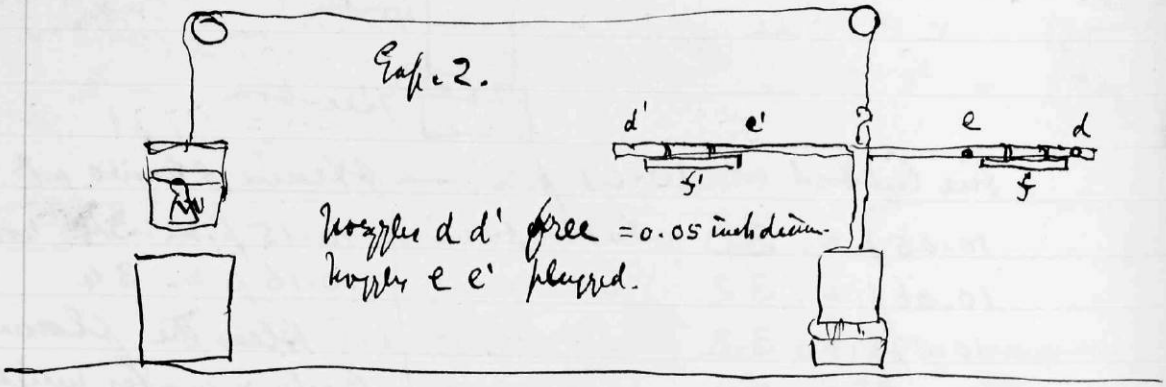
weight 370 grammes.

Paddles attached between the noggles — below pipes



Paddles arranged horizontally.

Apparatus without paddles = 5301 grammes
Two paddles = 370
370
Total weight 6041 grammes



~~Fire lighted~~ 10.49 p.m. Steam blows —— p.m.
Leaden plug not in — blew flame out — fitted leaden screw. All ready again.
Fire lighted 10.51 — Steam blows 10.52 p.m.

Exp. 2 continued

	10·53 p.m.	24	rotations per min.	11·00 p.m.	30 rot. per min.
(1)	10·54 "	30	" " "	11·01 "	30 " " "
(2)	10·55 "	30	" " "	11·02 "	28 " " "
(3)	10·56 "	28	" " "	11·03 "	30 " " "
(4)	10·57 "	28	" " "	~~11·04~~	Flame put out
(5)	10·58 "	30	" " "	~~11·05~~	
(6)	10·59 "	26	" " "	~~11·06~~	

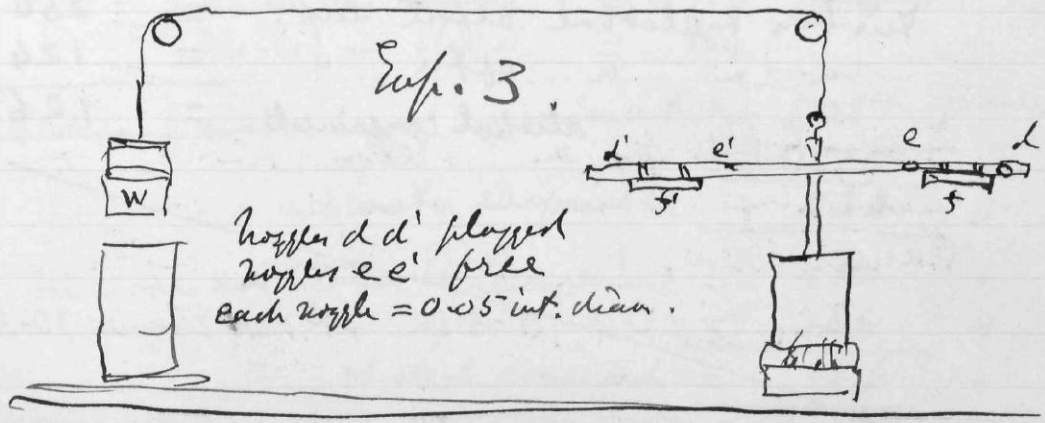
Boiler + water after exp. = 5330 grammes
Fire-box + alcohol " " = 197

Boiler + water before exp. =	~~6041~~	~~grammes~~	5791
" " " after " =	~~5330~~	"	5330
Water evap. =	~~711~~	"	461

Fire-box + alcohol before exp =	250	"
" " " after " =	197	"
Alcohol consumed =	53	"

Exp. 3. Same arrangement as Exp. 2 — but nozzles e e' free and nozzles d d' plugged up.
Diam. of orifice of each nozzle = 0.05 inch.

Boiler (paddles) and water = 5791 grammes
Fire-box + alcohol = 250 "
Total 6041 "



1872 June 2 — Monday — at Bibb

Exp. 3 continued.

Fire lighted at 11.50 p.m. Steam blows 11.58 p.m.

	11.52 p.m.	18	rot. per min	(6)	11.58 p.m.	19	rot. per min.
(1)	11.53 "	20	" " "	(7)	11.59 "	20	" " "
(2)	11.54 "	21	" " "		midnight "	13	" " " [string twisted many up]
(3)	11.55 "	20	" " "		12.01 "	16	" " "
(4)	11.56 "	20	" " "		12.02 "	8	" string twisted up.
(5)	11.57 "	20	" " "		~~12.03~~		Steam oiled — string twists up more than before.

~~12~~ ~~12.03~~

12.04 p.m.	11	rot. per min
12.05 "	16	" " "
12.06 "	18	" " "
12.07 "	Stopped. Alcohol burned out.	

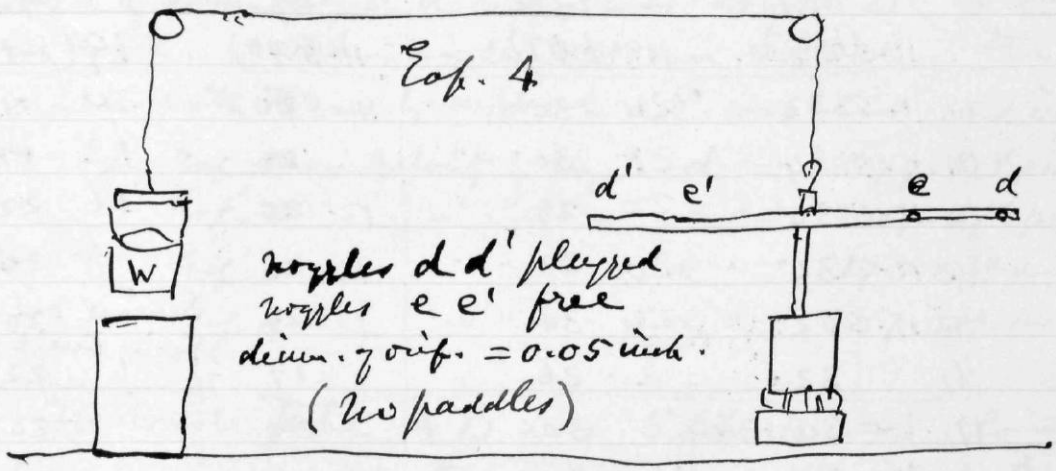
Boiler (paddles) and water = 5220
Fire-box & alcohol = 124

Boiler (paddles) and water before exp. = 5791
" " " " after " = 5220
water evaporated = 571

Fire-box & alcohol before exp. = 250
" " " after " = 124
alcohol consumed = 126

1892 June 2 — Thursday — at Bibb.

Exp. 4. Exp. 3 repeated without the paddles.



Boiler and water = 5051 grammes
Fire box and alcohol = 250
Total 5301 grammes

Fire lighted at 12·33 at night. Steam shows 12·34 at night.

12·35 after midnight. 17 rotat. per min.
12·36 at night. 16 " " "
(1) 12·37 " " 21 " " "
(2) 12·38 " " 22 " " "
(3) 12·39 " " 22 " " "
(4) 12·40 " " 24 " " "
(5) 12·41 at night 20 rot. per min.
(6) 12·42 " " 22 " " "
12·43 — Stopped going backwards — raised at working.
(7) 12·44 " 20 " " "
(8) 12·45 " 23 " " "
(9) 12·46 " 23 " " "
(10) 12·47 " 23 " " "

Boiler and water = 4718 grammes
Fire-box and alcohol = 164

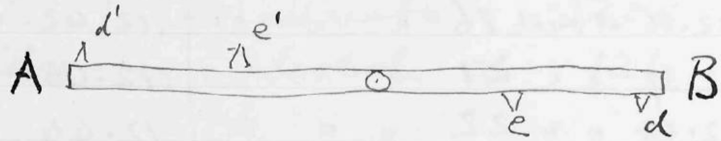
Boiler and water before experiment = 5051 grammes
" " - after " = 4718 "
water evaporated = 333 "

Fire-box and alcohol before experiment = 250 "
" " " after " = 164 "
alcohol consumed = 86 "

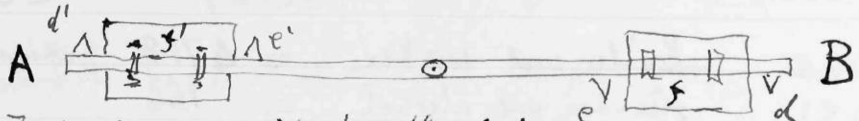
1892 June 2 — Thursday — at B.B.L.

Results of Exps. 1, 2, 3, & 4.

	Exp. 1 (p. 95)	Exp. 2 (p. 97)	Exp. 3 (p. 98)	Exp. 4 (p. 99)
(1)	32	30	20	21
(2)	34	30	21	22
(3)	34	28	20	22
(4)	34	28	20	24
(5)	32	30	20	20
(6)	32	26	19	22
(7)	34	30	20	20
(8)	30	30	— } alcohol began to give out.	23
(9)	34	28	—	23
(10)	34	30	—	23
Total	10 / 330	10 / 290	7 / 140	10 / 220
Mean number of rotations per minute	33	29	20	22



Nozzles d d' used [Exp. 1]. Result. 33 rotations per minute
Nozzles e e' used [Exp 4] Result. 22 rotations per minute



Tube loaded with paddles f f'

Nozzles dd' used [Exp. 2]. Result. 29 rotations per minute.
Nozzles ee' used [Exp. 3]. Result. 20 rotations per minute.

General Result: (1) The most advantageous location for nozzles is at the extreme end of the rotating pipe.
(2) The addition of wings or paddles — does not reduce the number of rotations very much — not nearly so much as I would have anticipated.

1892 June 2 — Thursday — at BBL.

When nozzles d d' were employed — the circular path traced by either nozzle d or d' was about 210 inches in length. When nozzles e e' were employed — the circular path traced by nozzles e or e' was about 102 inches.

In Exp. 1 — Velocity of nozzle d = 577.5 ft per min.
" Exp. 2 " " " " = 507.5 ft per min.
" Exp. 3 " " " e = 170.0 ft per min.
" Exp. 4 " " " e = 187.0 ft. per min.

The whole tube A B was 5 ft. 11 inches long. Assume circular path traced by extremity A of Tube AB = 18 feet. Then: —

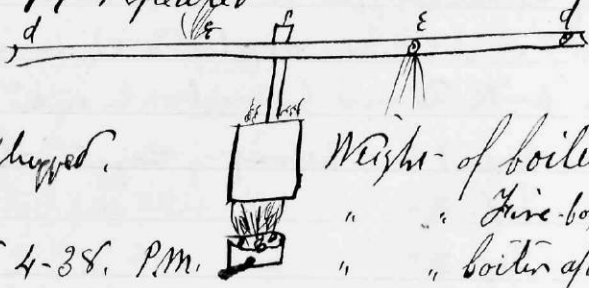
In Exp. 1 — Velocity of end A of Tube AB = 594 ft. per min.
" Exp. 2 " " " " " = 522 ft. per min.
" Exp. 3 " " " " " = 360 ft. per min.
" Exp. 4 " " " " " = 396 ft. per min.

Started at BBL — Thursday — June 2 — 1892 — although it is really Friday morning now. I leave for Boston at 5.30 a.m. Mabel, Mr. McClench — and Rose (Mabel's maid) accompany me. The steamer Mariner is to call at ~~this wharf~~ Brown Borough Wharf — at 5.30 a.m. Leave Alice, Daisy & Miss Clarke here.

A G B

1892 June 9th Thursday at B.B.L.

Expr 1 Expr #4. P 99 repeated



Drum Nozzle .05"

Nozzles d.d. plugged.

Weight of boiler + Water 5051 g
" " Fire-box + Alcohol 250 g
" " boiler after expr (with Water) 4572 gr
" " Fire-box " " 134 g

Fire started at 4-38. P.M.
Steam at 4-39.

Observations 1.	4-40.	Rev per minute			21.
2.	4-42.	"	"	"	21.
3.	4-44.	"	"	"	20.
4.	4-46.	"	"	"	24
5.	4-48.	"	"	"	24.
6.	4-50.	"	"	"	24.
7.	4-52.	"	"	"	24.
8.	4-54.	"	"	"	25.
9.	4-55.	"	"	"	25.
10.	4-57.	"	"	"	12.

Expr 2nd Expr #1. P. 95 repeated. Nozzles E.E. plugged, d.d. open.

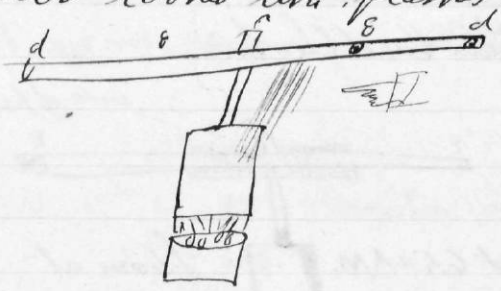
Weight of boiler and Water 5051 gr. Drum Nozzle .05" Fire at 5-32. P.M. Steam at 5-33. Weight of boiler + Water after expr 4501 gram

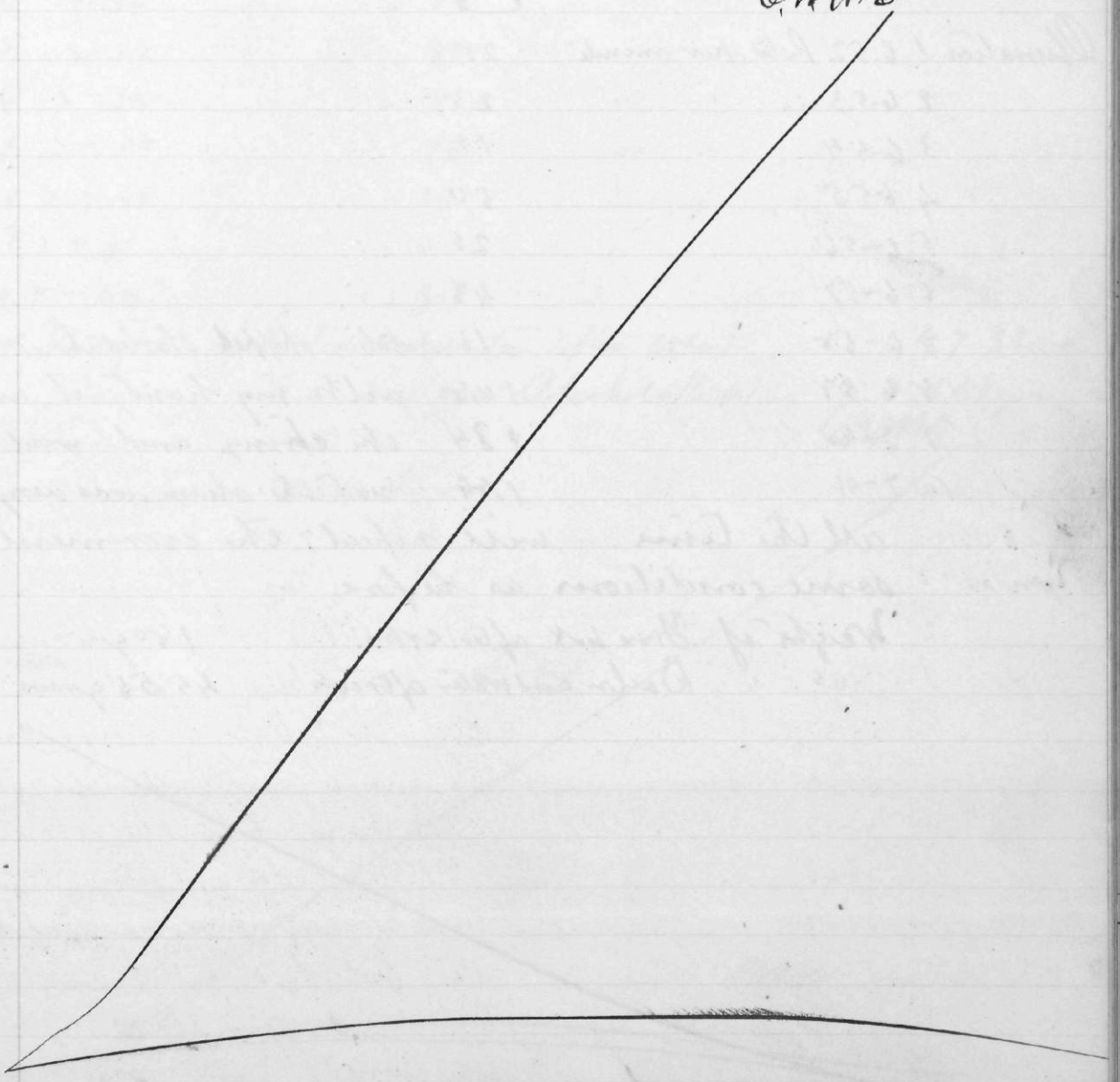
Weight of fire box + Alcohol 180. gram

Observations 1	5-34.	Rev per minute			21.
2	5-35.	"	"	"	21.
3	5-36.	"	"	"	25.
4	5-37.	"	"	"	35.
5	5-38.	"	"	"	38.
6	5-39.	"	"	"	37.
7	5-40.	"	"	"	42.
8	5-41.	"	"	"	40.
9	5-42.	"	"	"	35.
10	5-43.	"	"	"	25.

When 10th observation was just complete and rotations noted, I noticed the steam escaping from one nozzle in a very important sort of a way while the other nozzle was stopped very little steam escaping, I wanted to put out fire but first get behind chimney, as I expected something to bust; second thought save your head

1892. June 9th Thursday at B. B. Fe,
and saw the fires, called out the fire department,
just as fire was put out, pipe burst, and came out
toward boiler looked like flashes of lightning



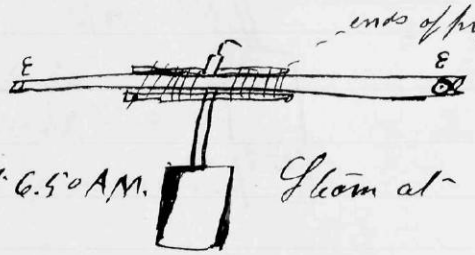


1892. June 10th at B.B. Lab.

Expt 1 Leiko Engine X 1 P 102. but the pipe has been cut of at the nozzles E. E. and end plugged up

Weight of boiler & water 50 51/2 g.

" " Fire bar & Alcohol 250 g.



Fire started at 6.50 A.M. Steam at 6.51

Observation 1	6.52	Rotations per minute	25
2	6.53	" " "	23
3	6.54	" " "	11
4	6.55	" " "	50
5	6.56		25
6	6.57		43
7	6.58		13 rotation stopped started the mach-
8	6.59		108 with my hand. it unwinded
9	7.00		134 the string and went like
10	7.01		1.86 mad. the steam, was very vigorous

all the time. will repeat the experiment same conditions as before

Weight of Fire box after expt 180 g.

" " Boiler and water after expt 45.56 grams

1882 June 10d. at B.B. Lab.

Expr 2 Repeat Expr #1. P 104.

Weight of Boiler & water 505 grm

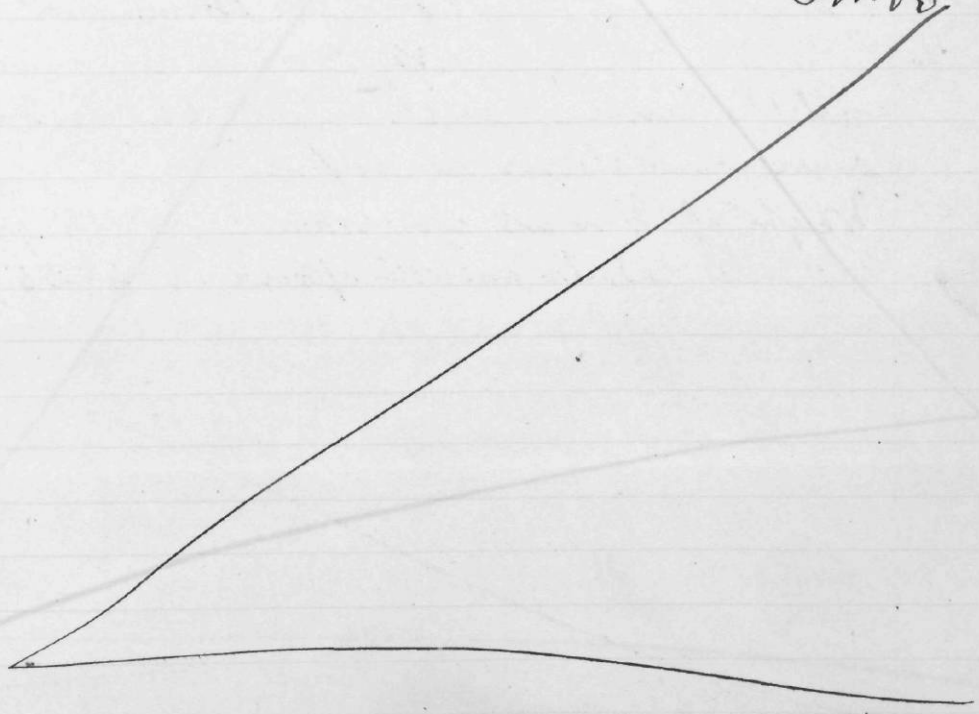
" " Fire box & Alcohol. 250 grm

Fire starts at 7-29. Steam at 7-30

Observation 1	7-31	27	
2	7-34	80	rotation stopped
3	7-35	82	
4	7-36	89	
5	7-37	89	
6	7-38	81	
7	7-39	94	
8	7-40	94	
9	7-41	93	
10	7-42	87	

Weight boiler and water after expr 473.2 gr

" " Fire box and Alcohol after expr 147 gr



1892 at B.B. June 18th at Leat
Finished setting towers to day it looks O.K.
will start on box Monday.
CWHE

1892 June 20th Monday at B.B. Hab.
Put the Aermotor together on the mountain
to day, and fitted it to the mast.
C.W.H.

1892 June 21st Tuesday at B.B.
The plumbers are at work at the cottage to day. Mr Mc Innis did not furnish a carpenter for them so the work is delayed, worked on the mountain part of this day

CMH

1892 July 5 Saturday at B.V.B.
Windmill erected to day, but not ballasted
tower fastened up with spring rope, to keep
wind from blowing it over.

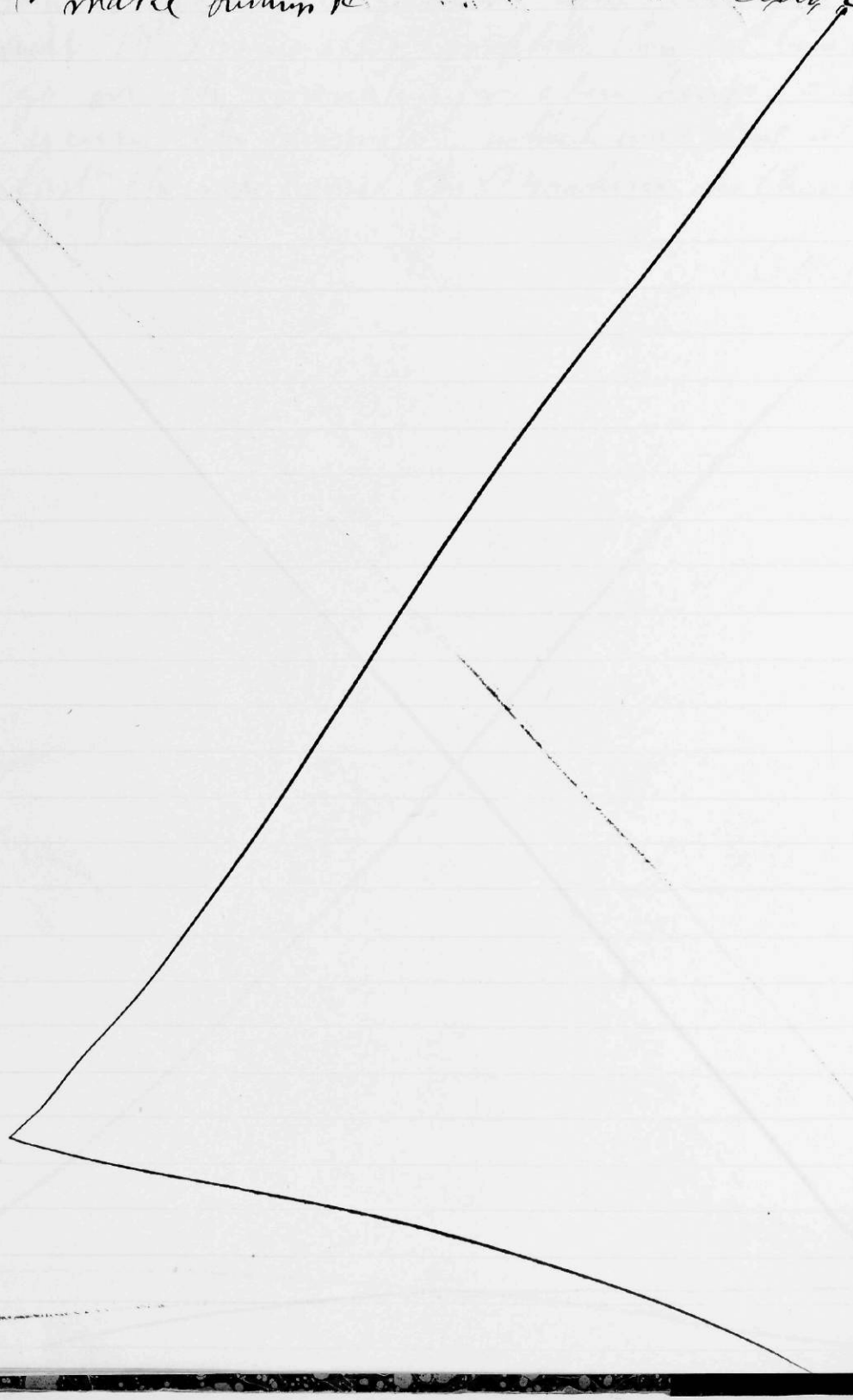
QW. N.E.

1892 - July 4. Monday at B.B.
Wind blowing a fierce gale. I am afraid
whole affair will go over, after lots of trouble
with Mc Innis & Mr Campbell. They let two men
go on the mountain for a few hours to help
secure the Aermotor, which was done at
last. The rope saved the Machine, no thanks to
Mc I.

C.W.H.E

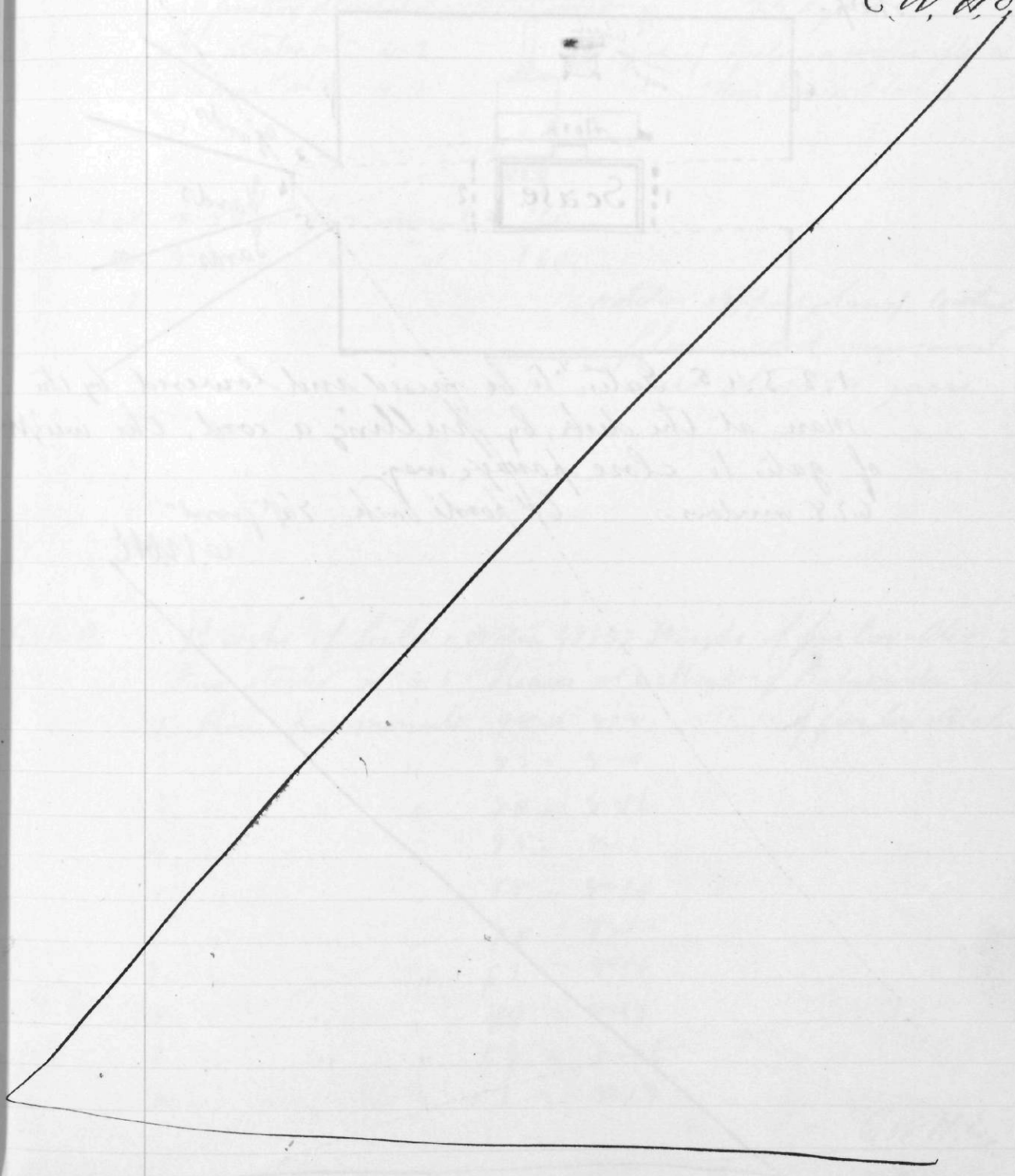
1872 July 5th Tuesday B.B.
Painting the windmill Almandon works well
B.H.H.

1892. July 21st Thursday at B.B.
Connelly pump and pipe in the trench house
to make button &c



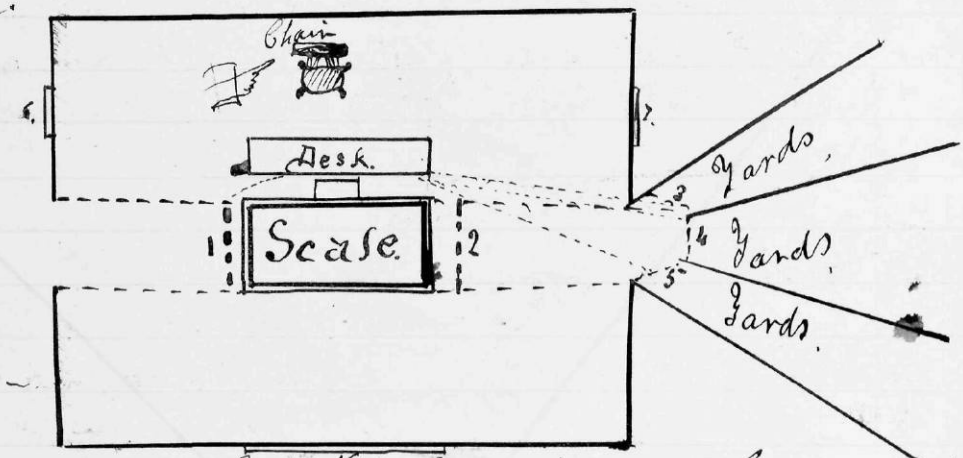
1872 July 25. Thursday at B. B.
Have made motion pipe and fitted starting
platform on windmill.

C. W. H.



1892. July 29th Friday at B.B.

Plan for a Weighing house, and. &c for the sheep.



1.2.3.4.5. Gates, to be raised and lowered. by the man at the desk, by pulling a cord, the weight of gate, to close passage way.

6.7.8. windows. 6ft. boards back. 7ft. front.

C.W.H.C.

1892 Aug 8th Monday at B.B.

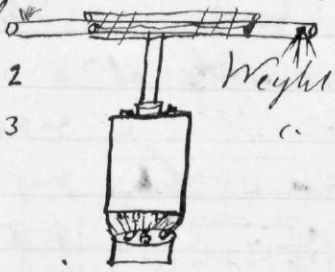
Exp^r #1 With boiler, and fire proof joints weight empty 4195g.

Weight of boiler & water 4985g

" fire box Alcohol 250g

Fire started at 4-2

Steam at 4-3



Weight of boiler & water after ex " " fire box & alcohol "

Observation 1 4-8½ Revs per minute 160.

2 4-9 " " " " 160.

3 " " " " rotation stopped, lamp, bracket

4 " " " " floor, cord unwound

5 " " " " mile start'd again

6 " " " "

7 " " " "

8 " " " "

9 " " " "

10 " " " "

Exp^r #2 Weight of boiler & Water 4985g Weight of fire box & Alco. 250g

Fire started at 8-5 Steam at 8-7 Weight of Boiler & water after 4615g

1. Revs per minute 98 at 8-8 " " of fire box & Alcohol after 1450g

2. " " " 83 " 8-10

3. " " " 80 " 8-12

4. " " " 95 " 8-13

5. " " " 88 " 8-14

6. " " " 72 - 8-15

7. " " " 63 - 8-16

8. " " " 48 - 8-17

9. " " " 54 - 8-18

10. " " " 52 - 8-19

C.W.N.E.

1892 Aug 8th Monday at B.B.

Expr #3 Weight of boiler & water 49 85g } Boiler & pipes same as
" " fire box and Alcohol 2.50g } in Ex 1 + 2 P. 115. Nozzle .05"

Fire started at 8-53 Steam at 8-55

1. Rev per minute at 8-56 - 88
2. " " " " 8-56 - 88.
3. " " " " 8-57 - 84. The wicks were
4. " " " " 8-58 - 88. not so high as
5. " " " " 8-59 - 92. in other Exprs
6. " " " " 8-60 - 88. (1 + 2) P 115
7. " " " " 9-1 - 92.
8. " " " " 9-2 - 92.
9. " " " " 9-3 - 88.
10. " " " " 9-4 - 88.

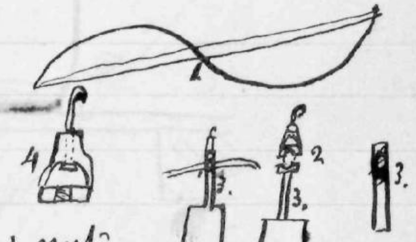
Weight of Boiler & water after Expr 47 15g } Nozzle 13" from
" " fire box & alcohol 189g } centre of pipe

1892 Aug 11th Thursday at B. B.

Expr 1st. Weight of boiler & Water 4955.g } Wings used in Expts on P 86. – 87. – 88. – Nozzles 0.05" diam
" " fire box & Alcohol 250g }

Fire started at 4 – 23 Steam at 4 – 24.

1. Rev per minute at 4 – 24 – 20. The joint on wings
2. 4 – 25 – 20. at 1. has been changed
3. 4 – 26 19. to make it proof against
4. 4 – 27 20. fire.
5. 4 – 28 20.
6. 4 – 29 21.
7. 4 – 30 16.
8. 4 – 31 12.
9. 4 – 32 5.
10. Stopped at 4-33.



Weight of boiler and water after expt 4685g. Weight fire box & Alcohol 185g

Asbestos washers used between ground, washers of brass 2. screw on pipe. 3.

Expt 2 Weight of boiler & Water 4955g. Weight of fire box & Alcohol. 250g

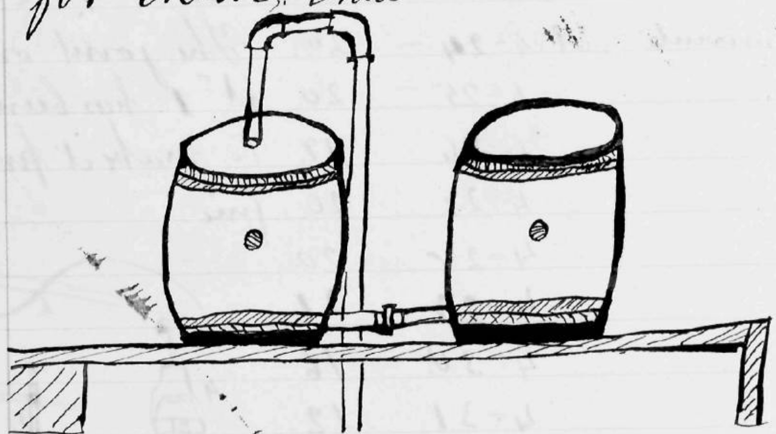
Weight of jacket 757 grams

Fire started at 5 – 00 Steam at 5 – 3 Nozzles 0.05" diam

1 Rev per minute at 5-4. – 19. Weight of boiler & W. after 4445g
2 " " " " 5-6. – 19. " fire box & A. after 165 g.
3 " " " " 5-7. – 23.
4 " " " " 5-8. – 25.
5 " " " " 5-9. – 25.
6 " " " " 5-10. – 25.
7 " " " " 5-11. – 25.
8 " " " " 5-12. – 25.
9 " " " " 5-13. – 23.
10 " " " " 5-14. 20.
11 " " " " 5-15. 20.
12 " " " " 5-16. 20.
13 " " " " 5-17. 18.
14. " Stopped at " " 5 – 20.

C.W.H.E.

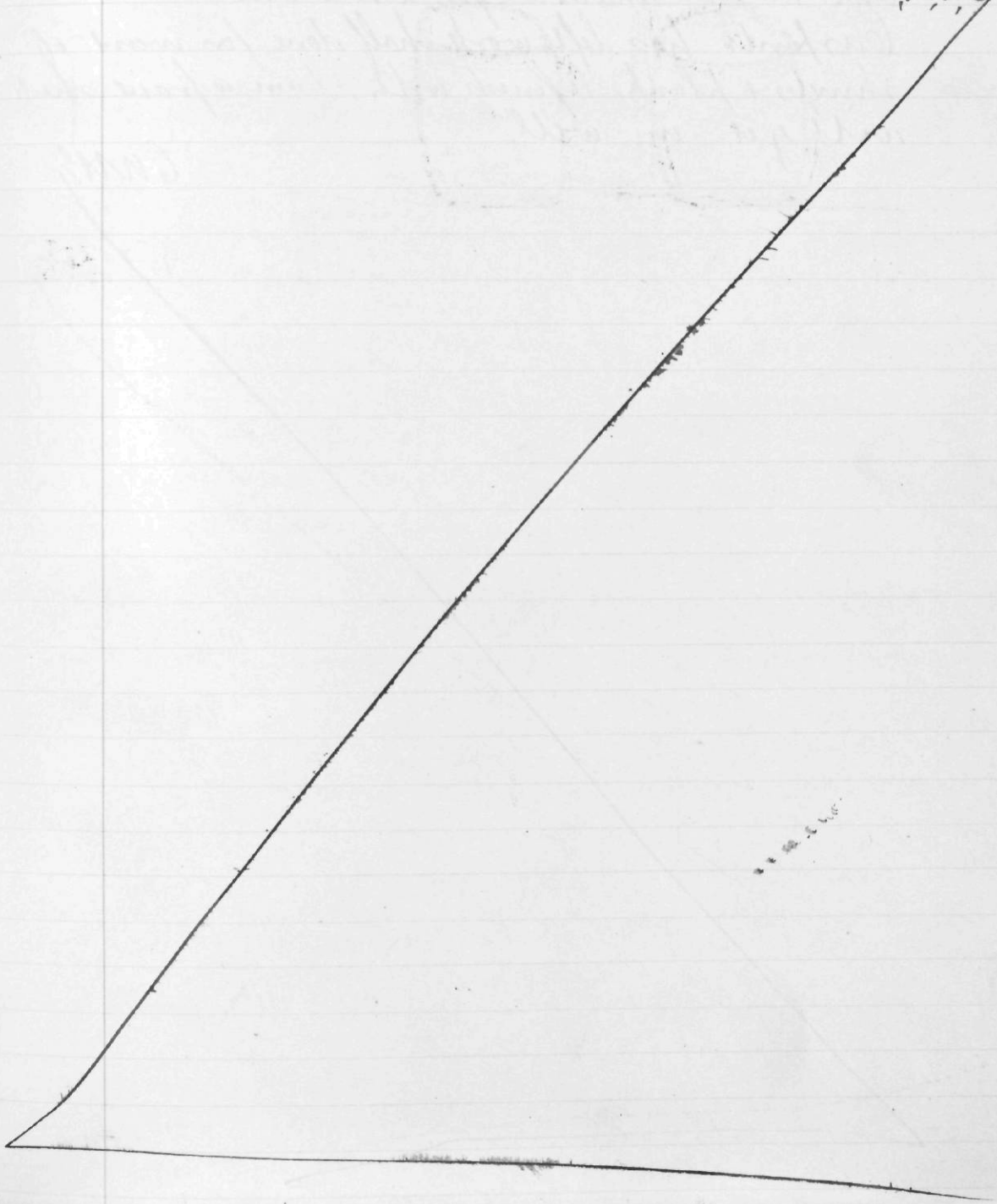
1892 Aug 12th Friday at B. B.
At last the barrels are ready, in barn for the pump. Today I have made pipe connections for them, thus



CWHE

1882. Aug 2 Saturday at B.B.
Have the bbls all ready for the water. the pipes are now fitted in, but pump rod must be cored up as the rain has swollen the mast, and made it tight in guides

C.H.B.G.



Aug 15th 1892 Monday at B. B.

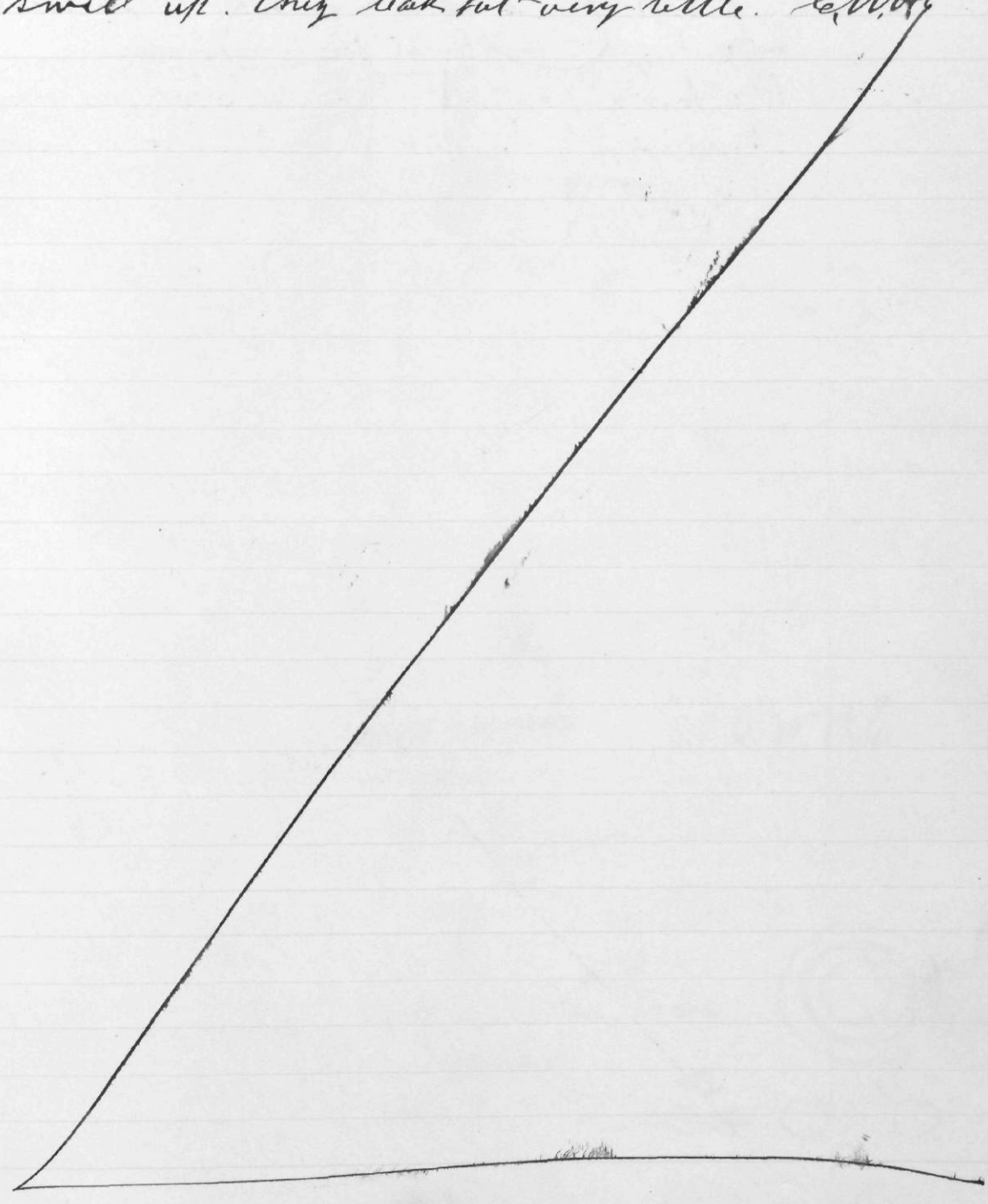
Started pumps to day it throws the water all right. the Barn & House are both supplied with plenty of water now.

We spliced the broken pump rod. as we are not able to get material for a new one

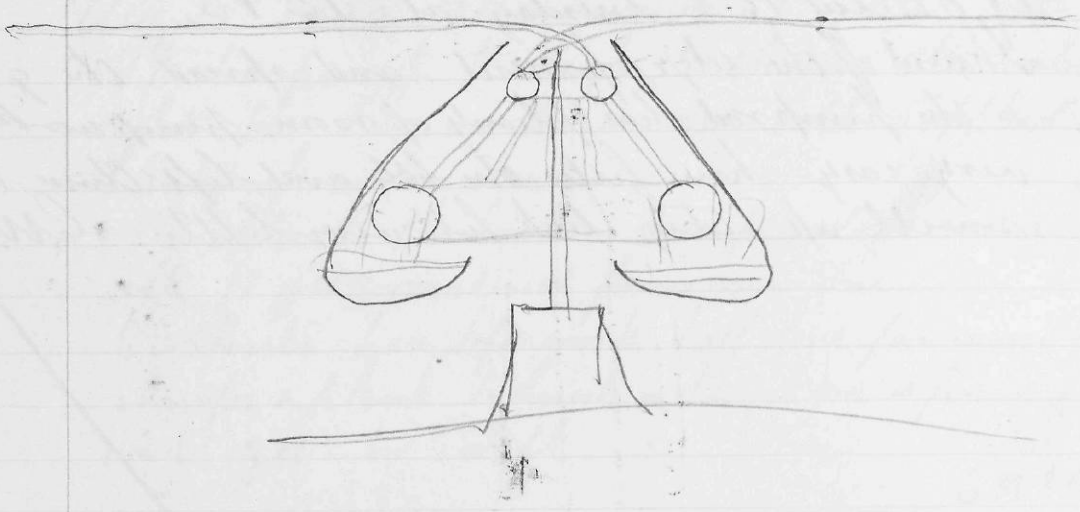
Carpenter has left work half done for want of shingles & plank. to finish with. I am afraid sheep will get in well.

C. M. H. G.

1892. Aug 16th Tuesday at B. B.
Shaved off the edge of mud; and spread the gravel so the pump rod has plenty of room, pump works very easy. have filled the bbls and left them to swell up. they leak but very little. C.W.H.



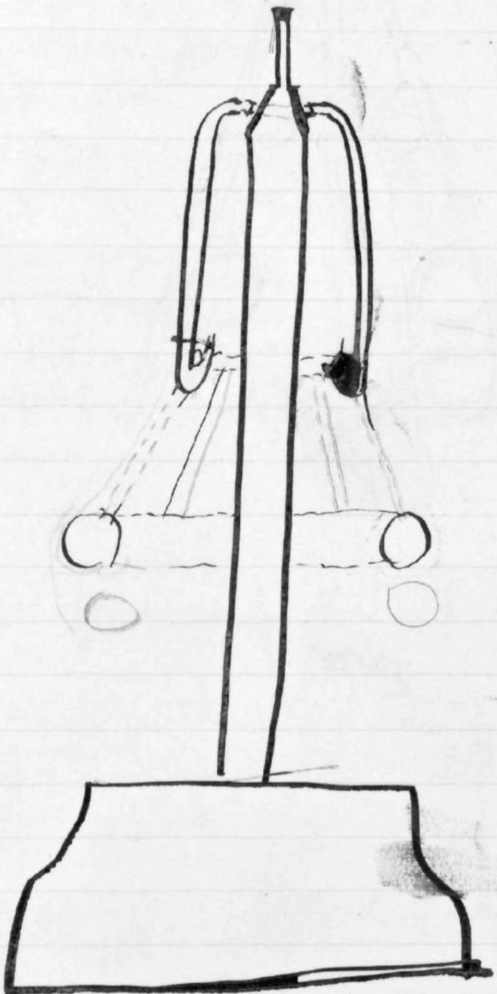
1892 Aug. 23 — Tuesday — at Burn Brae



1892 Sept. 3 — Sat — at BB. Lab.

Support for new boiler

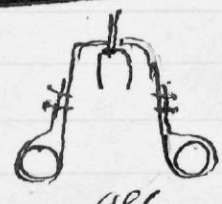
Thought of this



C.W.H.E.

Thought of AGB

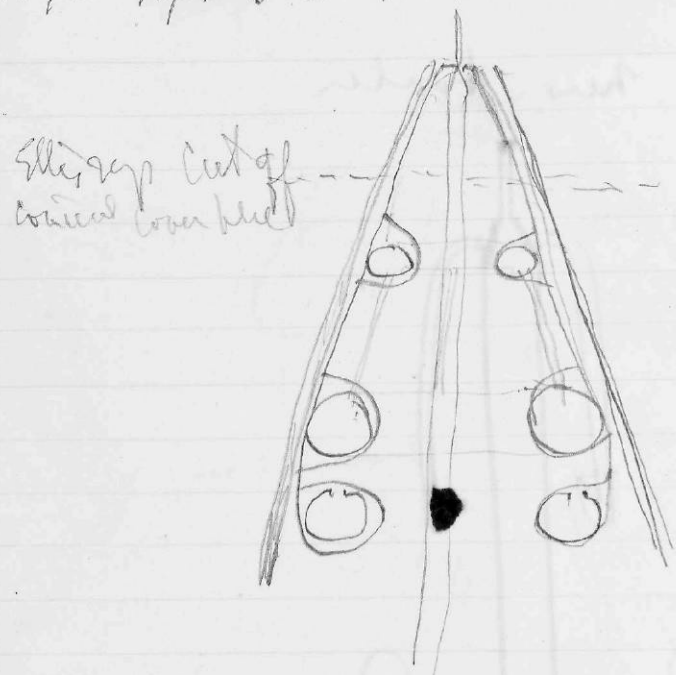
AGB

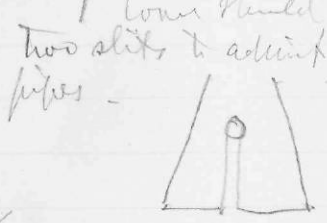


AGB

~~Wick~~ Fire box ~~heat~~ circular slit tube — circular wick — like Student

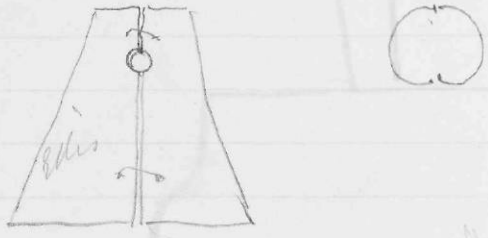
1892 Sept. 3 — sent — at 12½ Lab.





Thought Ellis. Thought

Make Cover in two pieces & hook together.



Old Thought Sept 3

Pipe within a pipe. Lamp

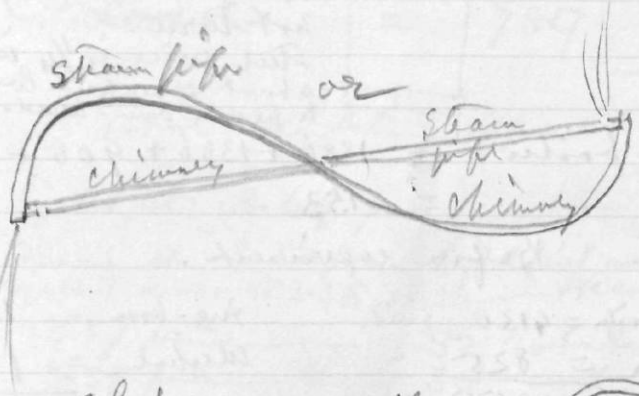
pipe constitutes chimney — & contraction will make draught & Cause fierce flame.

Objection. Inner pipe diameter — increases resistance Ellis. to contraction.

Thought Sept 3 — Put two pipes same diameter side by side — one for steam other

for chimney.

Use two pipes & get better support for wing.



Old arrangement

Steam pipe heated throughout — superheated steam — no condensation in pipe.

See pp. 91 & 92.

1892 sept. 5th — Monday — at RIS. Lab.

Exp. 1.

Exp. 1 p. 117 repeated exceptⁿ that machine is supported by stout steel wire (W) which will not turn. The steel wire is 1/4 inch diameter, about seventeen feet long — fastened directly to beam overhead.

Wing pins & boiler = 1386 + 1386 + 908 + 450 = 4130
Fire-box — = 153

Before experiment.

Wing-pins & boiler = 4130 grms.		fire-box =	153
water =	825 "	Alcohol =	197
Total.	4955 "	Total	350

As W. Ellis says that alcohol gave out on former experiment (p. 117) — we have increased amount of alcohol to 197 grammes making total weight of alcohol and fire-box = 350 grms. One object in former exps. (1 & 2 p. 117). The apparatus did not have the same weight in the two experiments on account of tin jacket used in experiment 2 p. 117. We now weigh tin jacket

Tin jacket &c. = 759 grms.

Will load apparatus with nearly equivalent weight.

Counter-balance of jacket —
Iron rod & two pins & wire = 789 grms.

Rod fastened vertically to upright post of wing-pins so as to interfere as little as possible with rotation — see drawing above.

Exp. 1 (continued)

Kafoor copper.

Wing p. & boiler	= 4130	
Water	= 825	4955
Fire box	= 153	
alcohol	= 197	350
Load	= 789	789

Total weight of apparatus = 6094 grms.

Fire lighted at 3.49 p.m.

Steam shows at 3.52 p.m. Light fuse and & alcohol lamp refilled
Fire lighted again at 3.55 p.m. —— steam shows at 3.55½

1.	3.57 p.m.		32 revolutions per min.
2.	3.59 p.m.	(1)	35 rev.
3.	4.01 p.m.	(2)	34 " " "
4	4.03 p.m.	(3)	34 " " "
5.	4.05		33 } counted 65 revolutions in
6.	4.06		32 } two minutes.
7.	4.08	(4)	35
8.	4.10	(5)	35
9.	4.12		27
10.	4.14	Stopped — alcohol burned out.	

Temperature & room 71° F.

Mean & 5 observations marked (1, 2, 3, 4, 5) = 34.6 rev.
Circular path & nozzle = 18 ft. hence velocity & nozzle = 622.8 ft per minute or 10.38 ft/sec.
after experiment

Fire-box & alcoh = 197 Wing-piece, boiler, water, & load = 4884

Wing piece, water, boiler & load — before exp. 5744
" " " " " after exp. 4884

water evaporated = 860 grms

Fire-box & alcoh — before exp 350
" " " after exp. 197

alcohol consumed = 153

5744
5206
water evap. = 538 grms.

1892 Sept-5 — Monday — at B.B. Lab.

Exp-2 (Repetition of Exp-2 p-117 excepting that stiff ~~w~~ suspension wire used in place of cord line.)

~~Before exp~~ Before taper.

wing pump bottle	=	4130	
water	=	825	4955
Zinc-box	=	153	
Alcohol	=	197	350
Zinc-jacket	=	759	
extra-weight	=	30	789

Total weight of apparatus = 6094 grammes.

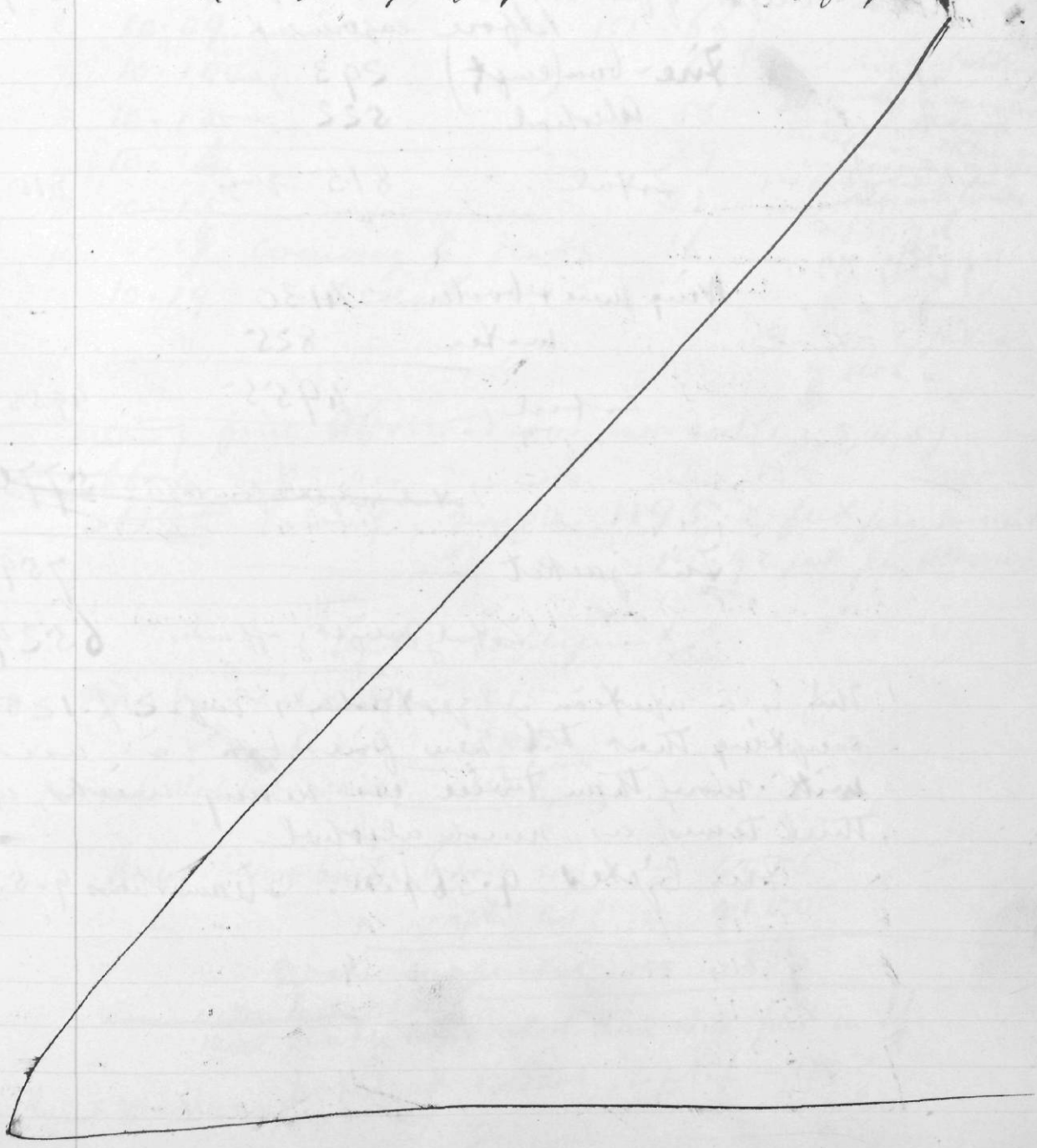
Zinc started at 4·59 p.m. — Steam steamed at 5 p.m.

	Time		Rotations
1	5·02 p.m.		38 rotations per min
2	5·04	(1)	42 " " "
3	5·06 p.m.	(2)	42 " " "
4	5·08 p.m.	(3)	41 " " "
5	5·10 p.m.	(4)	40 " " "
6	5·12 p.m.	(5)	40 " " "
7	5·14 p.m.		39 " " "
8	5·16 p.m.		35 " " "
9	5·18 p.m.		29 " " "
10	5·20 p.m.		Stopped.

Expt. 2 (Continued.)

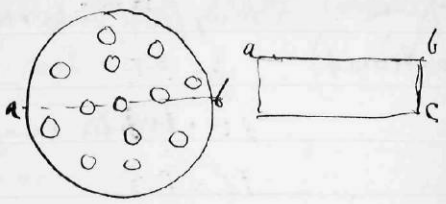
Wing plate, bottle + water before exp.	4955	Fine bore + alcohol before exp.	350
after exp.	4553	after exp.	176
Water evaporated	402	Alcohol consumed.	174

Mean of 5 observations noted (1,2,3,4 × 8') = 41 rot. per min.
Velocity of nozzle 738 ft. per min. or 12.3 ft. per second.



1892 Sept. 6 — Tuesday — at BB. Lab.

Exp. 1 New fire-box made today —



13 wick holes.

Diam ab = 14.0 cm.

Depth bc = 4.5 cm. 3 suspension wires

Weight of fire-box & wicks & suspension wires = 293 gms.

Before experiment.

Fire-box (empty)	293 gms.	
Alcohol	522 gms.	
Total	815 gms.	815

Wing burner & bottle = 4130

water = 825

Total 4955 4955

~~Total weight before tapping 5770~~

Tin-jacket 759

Total weight of apparatus 6529

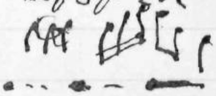
This is a repetition of yesterday's Exp. 2 p. 128 — excepting that the new fire-box is used with more than twice as many wicks, and three times as much alcohol.

Fire lighted 9.56 p.m. Steam shows 9.57

	Time		Rotations
1	9.59		58
2	10.01	(1)	66
3	10.04	(2)	67
4	10.05	(3)	66
5	10.07	(4)	67
6	10.09	(5)	66
7	10.10		63
8	10.12		55
9	10.13		39
10	10.15		31
11	10.17 coming to rest		16
12	10.19 at rest.		

noise of friction makes a musical tone — at each rotation — then a succession of notes at each rotation musical tones

mfsf zd



S—D = C pitch of dot.

Mean of five ~~obs~~ rotations marked (1, 2, 3, 4, 5) — 66.4 rot. per minute

~~1195~~ velocity of nozzle 1195.2 feet per minute
or 19.92 feet per second.

After experiment.

Fire box + alcohol (before)	815
" " " " after exp.	289
Consumed alcohol + burned wick &c.	526

~~Boiler~~ piping + boiler + water before exp.	=	4955
" " " " after exp.	=	4100
~~W~~ Water evaporated	=	855

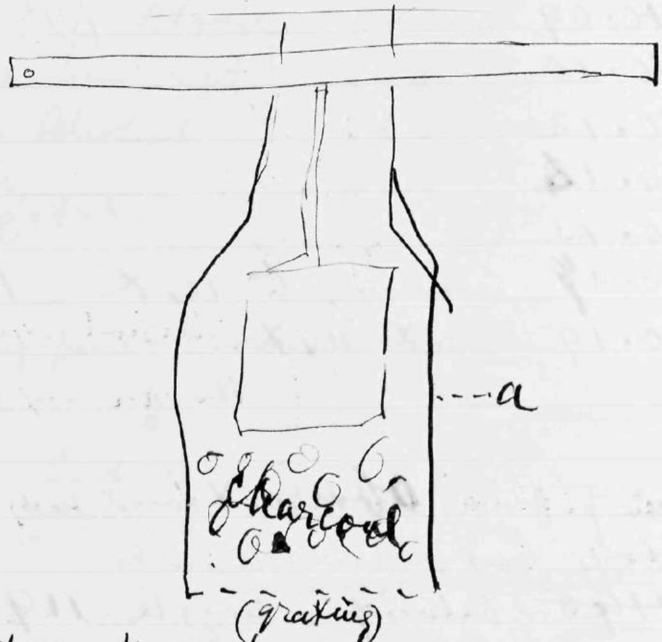
~~Some water left~~ More water evaporated than was put in!!

Noted at B.B. Lab. Sept. 6 — 1892
a.g.b.

Present Mr. Ellis + Mr. John McKillop — a.g.b.

1892 Sept. 7 — Wed — at BB Lab.

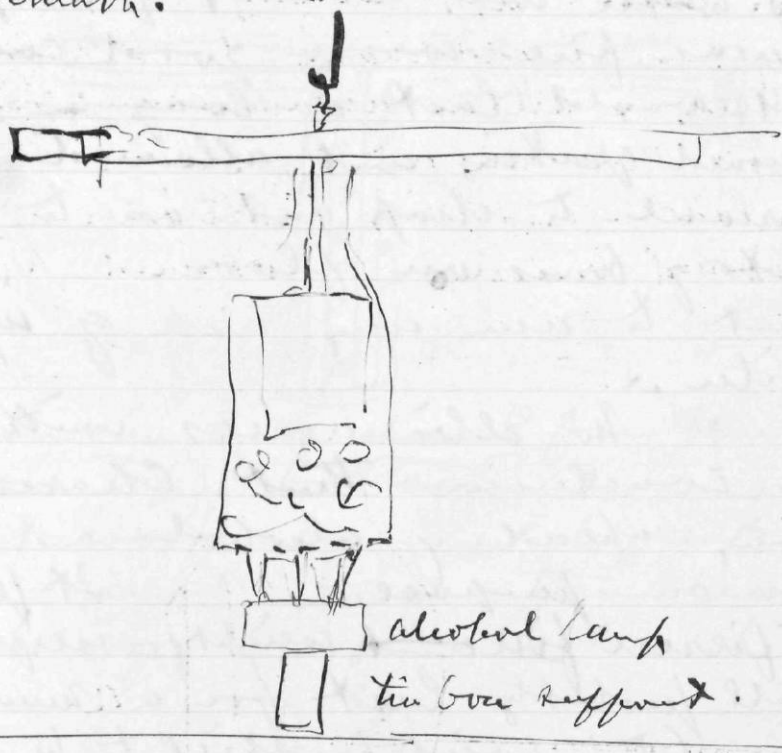
Exp. 1 Major Powell left today — Took him in tug-boat Rudderham to Orangedale — Mr McCurdy & Aileen accompanied us. Picked up Dr. MacKeen at Baddeck. Saw Miss Riddle and Miss Kittridge at Orangedale — on board train. Returned here evening.



Rotating tube has been arranged for experiment tomorrow. The tin jacket (a) has been provided with a wire grating below — and a charcoal fire will be lighted. 500 grammes of charcoal has been weighed out — but jacket will not hold it all. ~~As~~ Desire simply to see how charcoal fire will do — Will not ~~make~~ take up time by noting weights &c — or measurements of the pipes — as it is evening (8.36 p.m.) — and I don't want to take up Mr. Ellis' time.

Mr Ellis will start the charcoal fire — by an alcohol lamp — placed

underneath.



~~The~~ Alcohol lighted 8.39 p.m. ~~It~~
Alcohol Lamp put out at 8.41 p.m. as
Charcoal seems to be lighted.

Mr. Ellis has weighed the charcoal left over. It equals 143 grammes.

$$\begin{array}{r} 500 - \\ 143 \\ \hline 357 \end{array}$$

grammes, charcoal for the fire.

8.46 p.m. Steam coming & Lamp put & jacket red-hot.

8.48	——	about 100 rot-p.m.	
8.50	—	27 in 1/4 min. counted by puffs.	108
8.51	—	30 " " "	120
8.52	—	30 " " "	120
8.53	—	31 " "	124
8.54	—	26 " "	104
8.55	—	19 " " " (water giving out)	76

1892 Sept. 7 – Wed – at WB Lab.

Exp. 1 continued

As water was evidently giving out whereas fire was in good condition and would last a long – Mr Ellis removed grating and allowed charcoal to drop out on to sheets of brass on floor. Don't want to run any risk of injuring boiler.

Remark.

Mr Ellis agrees with me in the conclusion that Charcoal is away ahead of alcohol as fuel for our purpose. It produces a fiercer fire weight for weight – and will probably last for a much longer time (this point has still to be demonstrated) It is besides very much cheaper. Mr. Ellis says that the alcohol burned at each experiment – costs as much as a bushel of charcoal.

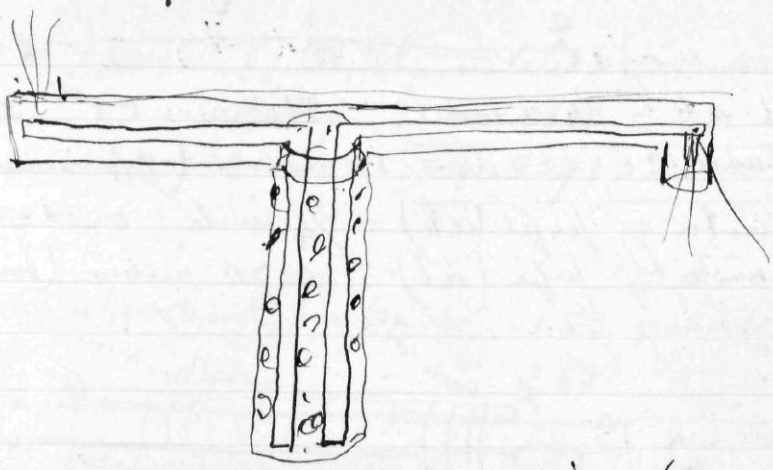
At 120 rev. per min. calculate velocity of nipple. circular pitch = 3+34 inches = 102 vel. = 102 + 120 = 12240 inches per min. = 1020 ft per min. = 17 ft per second.

120
102
240
1200
12240
12 | 1020
62 | 17 ft per sec.

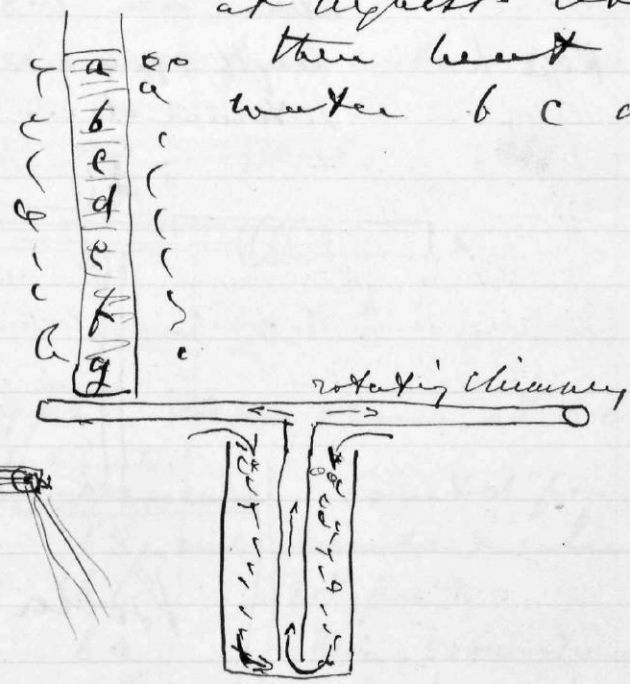
Noted Sept. 8. in 1892 book

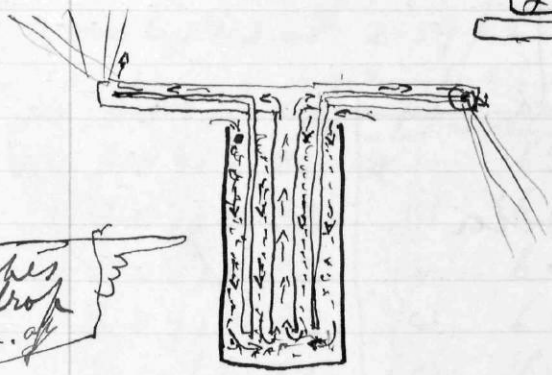
Noted Sept. 7 – 1892

1892 Sept-7 — Wed — at BB Lab.



Night Cop If you can make charcoal fire burn downward from top to bottom so as to heat water at highest level (a) — and then heat successive layers of water b c d &c.





No ashes could drop down.

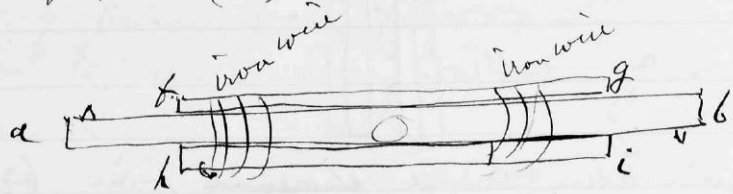
Mr. Ellis says — heard to start fire — rotation necessary to produce the draught.

Noted Sept. 7 1892 GJ

1892 Sept 8 – Thursday – at BB. Lab.

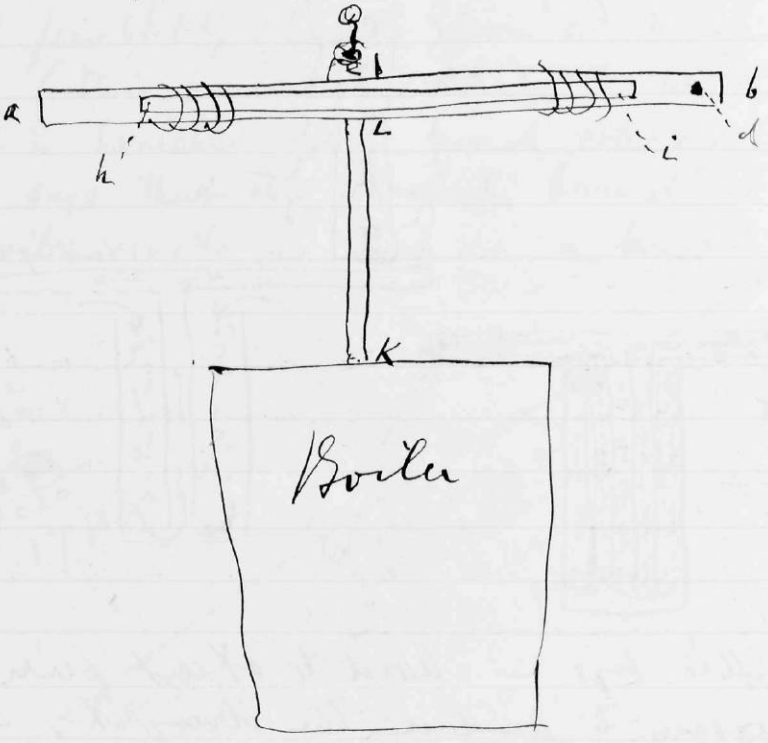
Exp. 1.

Length ab = 34.2 inches. Distance cd = 34 inches (under a little)
Distance ce = ed = 17 inches (approximate)
External diameter of pipe (ab) = 3/4 inch or 0.75 inch.
External diameter of pipe (ab) = 0.70 inches. (exact)



Pipe fg. Length 17.4 inches. External diam. 0.65 inches
Internal diam 0.55 inches.

Pipe hi. Length 17.4 inches External diam 0.65
Internal diam 0.55



Pipe KL – Length from top of boiler to insertion in pipe (ab) 7.50 inches. Ext. diam ~~0.30~~ 0.40 inches
Int. diam. ~~0.25~~ 0.28 inches.

1892 Sept 8 — Hennaley — at WB Lab.

Exp. 1 continued —

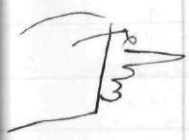
Boiler & pipes ab, fg, hi, kl. = 4418 grammes
water = 953 "
Total boiler &c. = 5371 "

empty	filled
1386	1386
1386	1386
1386	1386
200	200
50	100
10	5
4418	5371

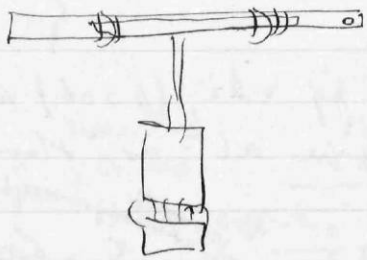
Old alcohol & fire-box (switched) = 153 grammes (accepted old pipes not weighed)
alcohol = 268 "
Total fire-box & alcohol = 421 "

(filled)
200
100
100
20
1
421

Experiment II



Distance of each nozzle from centre = 17 inches to projecting pipe.



Fire lighted at 2.59 p.m. Steam blown at 3.03 p.m.

Time	rotations per minute.	
(1) 3.05 p.m.	36 (~~72~~ in one half-minute)	72 per minute
(2) 3.06 p.m.	34 (1)	68 per minute
(3) 3.07 p.m.	33 (2)	66
(4) 3.08 p.m.	32 (3)	64
(5) 3.09 p.m.	33 (4)	66
(6) 3.10 p.m.	32 (5)	64
(7) 3.11 p.m.	29	58
(8) 3.12 p.m.	28	56
(9)	Stopped as evidently water	
(10)	or alcohol begins to give out.	

5 | 328
65.6

Counted for one-half minute & calculated rot. per m.
Mean of 5 observations (1, 2, 3, 4 & 5) = 65.6 rotations per minute.

N.B. ~~Worked~~ The pipe did not start into rotation by itself although good steam blown. Mr Ellis started it with hand as apparatus then rotated continuously as noted until fire was put out. Circum. path of nozzle = 102 inches (approx.)

65.6 × 102 = 6691.2 inches per minute = velocity of end of pipe in Exp. 1.

6691.2 / 12 = 557.6 ft per min.
557.6 / 60 = 9.293 ft per sec.

1892 Sept 8 — Thursday — at BB — Lab.

Total boiler &c.

Before exp. = 5371
After exp. = 4698
Water exp. = 673 grammes

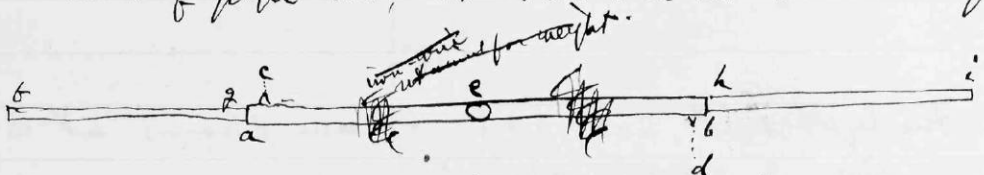
after exp.
1386
1386
1386
500
20
10
5
2
2
1
4698

Fire box &c

Before experiment 421
After experiment 266
Total alcohol consumed 155 grammes.

100
100
50
10
5
1
266

Exp. 2. The pipes fg, & hi, (p.136) will now be soldered to ends of pipe ab, as shewn in next diagram.



distance ed = 17 inches — distance ei = 34.5 inches (approx)
ec = 17 " " ef = 34.5 " (approx)

The two pipes & iron wire used to tie pipes together in Exp. 1. will be retained so that weight & appearance may be the same as before as nearly as possible. Iron wire will not be retained as the solder required to join pipes will about equal weight of iron wire

Boiler &c full = 5371 grammes as before
Fire box full = 421 grammes as before

The lights 4.48 p.m. Steam steams at 4.51 p.m. 4.52 p.m. Steam good but does not start rotating W. Ellis will start the rot. by hand. He started

Exp. 2 continued.

	Time	Rotations per ½ min.	Rotations per minute
1	34·54	11	(1) 22
2	34·55	12	(2) 24
3	34·56	——	(3) 23 (half rot. in ½ min)
4	34·57	——	(4) 22
5	4·58	——	17
6	4·59	——	15
7	4·00	——	19
8	Time first and last.		
9	209·25		
10	22·75		
	104625		
	146475		
	41850		
	41850		
2	4760·4375 water per min		
60	396·7 feet per min		
	6·61 ft. per sec.		

Rotations by tapping the suspension wire.

~~Mean of 4 observations = 22·75~~

Mean of 4 observations (1, 2, 3, & 4) equals 22·75 rotations per minute.

4)91
22·75

~~Circular path of end of pipe (i) equals = 396·7 feet = 69·75 inches~~

Measurement of dist. fc = 69·75 inches

Circular path of i = 69·75 × 3 = 209·25 inches

Velocity of end (i) = 209·25 × 22·75 = 4760·4375 inches per min

= 396·7 ft per min = 6·61 ft per sec.

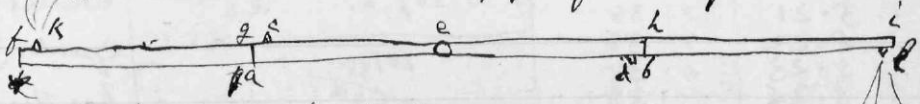
Total Water fc.

Before exp.	5371	1386
after exp.	4668	1386
water evap. =	703 grammes	1386
		500
		20
		10
		4668

Fire-box fc

Before exp.	421	200
after exp.	257	50
alcohol consumed =	164	5
		2
		257

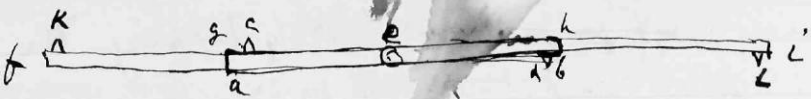
Exp. 3. The pipes fg & hi (p. 136) have been removed from pipe (ab) and the ends of the pipe (ab) are now being unsoldered. The pipes fg & hi — will then be soldered to pipe (ab) so as to make a continuous pipe from f to i.



Nozzles cd will be plugged — (soldered) up — and nozzles KC will be used — of same diam as (cd) viz:— 0·05 inches internal diameter.

1892 Sept. 8 — Thursday — at Elb Lake,

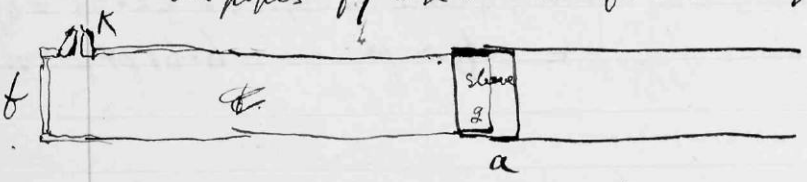
Exp. 3
(continued)



will measure distance fi — should be less than in Exp. 2 — because the pipe hi — is slipped into end g pipe (ab) some distance — same true g pipe fg.

ed = 17 inches dL = 17.25 Li = 25″ ∴ ei = 34.50
ec = 17 " cK = 17.25″ Kf = 25″ ef = 34.50
(appears) 69.00

Find that Mr. Eells has used two brass sleeves in connecting pipes together. Sleeves were slipped loosely on pipes fg - hi - in former exps. 1 & 2 (pp. 136 & 139)



so that their weight has been included in these experiments.

The small discs g brass used as stoppers to stop up end g pipe (ab) in former exps. 1 & 2 — will be attached to apparatus — so that their weight may be included in present experiment.

Weight g brass tube as before = 5371 grammes
Weight g fine brass tube " " = 421 grammes

Fire lighted at 5.11 p.m. Steam shows at 5.14 p.m.

Rotations. Started

Time		rot. per m.
1	5.16 p.m.	45″
2.	5.17	44
3.	5.18	41
4.	5.19	40
5.	5.20	(1) 38
6.	5.21	(2) 38
7.	5.22	(3) 38
8.	5.23	(4) 38
9.	5.24	(5) 38
10.	5.25	39
11	5.26	39
12	5.27	38
13	5.28	37

Started & steady 5.15

Time	rot. per m.
14. 5.29 p.m.	32
15. 5.30 p.m.	25″

20738
165
621
78665.5
12 6 10.925″
60

Mean of 5 observations marked (1, 2, 3, 4, & 5) — equals 38 rotations per minute.

Exp. 3 continued

Boiler &c.

Before experiment = 5'371
after " = 4478 ✻
Water evap. = 893 ✻

1386
1386
1386
200
100
10
5
2
2
1
4478 ✻

✻ Sept. 9th 93 agt

Fire box &c.

Before exper. = 421
after exper = 206
Alcohol consumed =

200
5
1
206

Circular path = 69 × 3 inches = 207 inches.
Velocity of end of piston = 207 × 38 = 7866 inches per minute
= 655 feet per minute
= 10.925 feet per second.

Results.

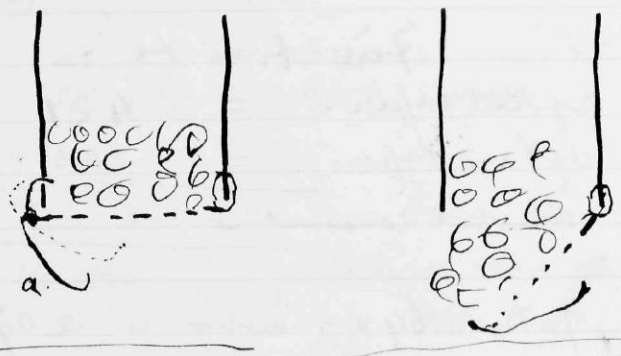
Exp.	Rot. per min.	circular path of end of piston.	velocity of end of piston.	velocity in feet per second.
Exp. 1.	65.6	102 inches	557.6 ft. per min	9.293
Exp. 2.	22.75	209.25 inches	396.7 ft per min	6.61
Exp. 3.	38.00	207 inches	655.5 ft per min	10.925

Results of Exps. 1, 2, & 3.

1892 Sept. 9 — Friday — at U.S. Lab.

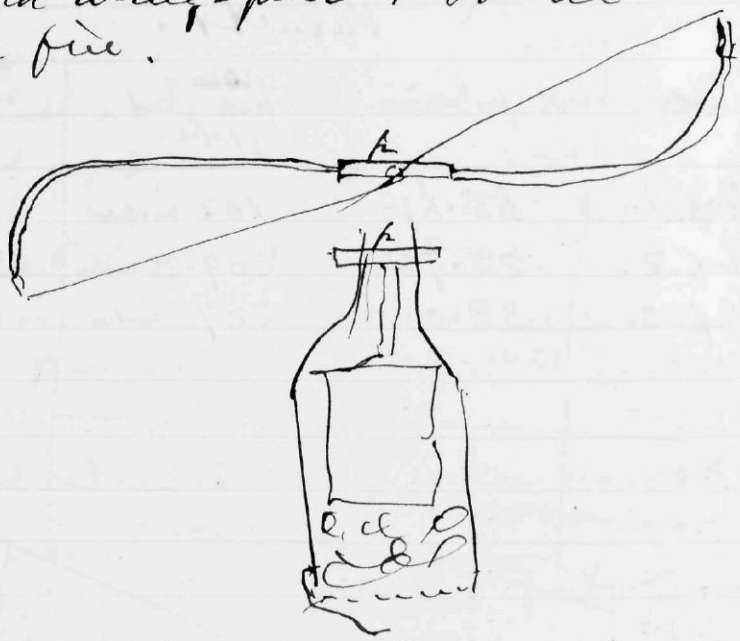
Charcoal trap. (Ellis)

Mr. Ellis yesterday made a trap to drop charcoal fire when desired — & thus save boiler — for charcoal fire outlasts the water in boiler.



By touching lever (a) trap opens & lets out charcoal fire.

Sept. 1, Test old wing-piece & boiler — with charcoal fire.



Wing piece has been threaded by central piece & pipe (k) 7.75 inches long By external diam.' 0.50.

1892 Sept. 9 — Friday — at Bls. Lab.

Expt 1 continued

Boiler &c — (empty) = 4148 grammes
water = 807
Total boiler + water = 4955 4955

1386
1386
1386
500
300
4958 −3
3
4955

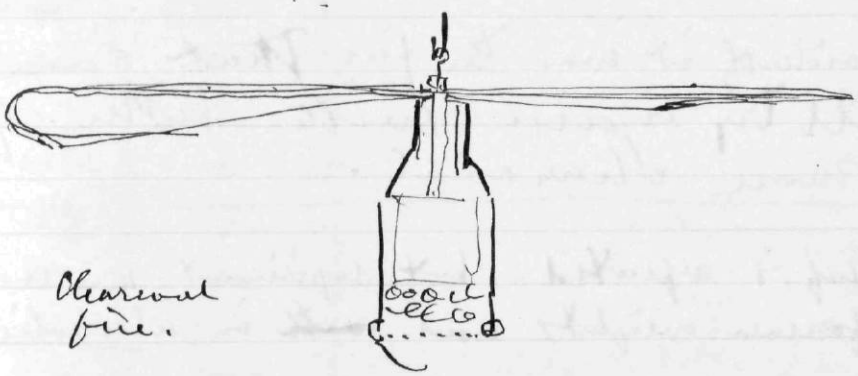
1386
1386
1386
−10
4158
10
4148

Fire jacket + trays = 812
Charcoal = 327
Total jacket + fuel. = 1139 1139

500
200
100
10
2
812

Total apparatus 6094

Charcoal (element left)
200
100
10
20
5
2
327



Charcoal fire.

Fire lighted at 1.04 p.m. — steam shows — 1.12 p.m.
Started by alcohol lamp underneath burned for one minute.

Time	rotations
1.14 p.m.	44 (1)
1.15	47 (2)
1.16	51 (3)
1.17	54 (4)
1.18	54 (5)
1.19	41
~~1.20~~	Water on fire & fires out —

5 | 250
50

Screw fire with Ellis lever.
Mean of 5 observ. = 50 rotat. per minute.
velocity = 18 × 50 = 900 ft. p. min.
= 15 ft p. second

327
Charcoal left weighs 145 grammes
Charcoal consumed 182 grams

Not satisfactory — try again. Fire not good. Jacket did not become red hot.

1882 Sept. 9 – Friday – at BB Lab

Exp. 1
Cont.

Boiler &c.

Before experiment	=	4955
after experiment	=	4658
Water evaporated.	=	297 grammes

1386
1386
1386 4158
500
4658

~~Charcoal~~ Charcoal

Before experiment	=	327
After experiment	=	145
Charcoal consumed	=	182

Evidently it was the fire that came out. Will try again with better fire & more charcoal.

Exp. 2

Exp. 1 repeated – but experiment made independently, & former weights used ~~with~~ in alcoholic exps. (?)

Boiler+air-pump+water = 5000 grammes
Boiler+empty = 4148
water = 852

3×1386 = 4158
500
200
100
50-8 = 42
5000

Mr. Ellis is weighing some charcoal. After he has filled the tin jacket he will weigh what charcoal is left over – and then ascertain how much has been used.

Charcoal used 530 – 19 = 511 grammes

Fire lighted 1.46 p.m. Alcohol lamp will be allowed to burn for a sufficient length of time to ignite the charcoal thoroughly. Lamp removed at 1.50 p.m.
Fire evidently good. Steam shows at 1.54 p.m.
(Smoke rises to roof of lab.).

Time	Rotations
1.57½ p.m.	34
1.58	39
1.59	42
2.00	42
2.01	38
2.02	36
2.03	36
2.04	37
2.05	40
2.06	41
2.07	42
2.08	40
2.09	37
2.10	34
2.11	32
2.12	29
2.13	Stopped fire drew fire

Not a satisfactory experiment as fire did not reach jacketted red-hot — Seems to be more friction at suspension wire — Rotation hard to be started by jarring the suspension-wire — and noise of grinding heard.

Charcoal

Before experiment = 511
After experiment = 209
Charcoal consumed = 302

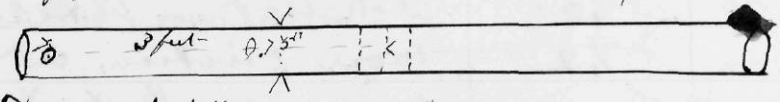
Water

Before experiment = 5000
After experiment = 4348
Water evaporated = 652

	4158
	100
	50
	20
852	10
652	5
200	2
	2
	1
	4348

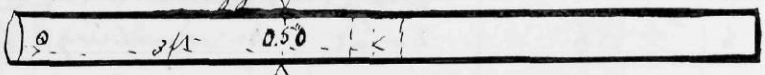
1892 Sept 10th Saturday at B. B.
Have made three straight pipes. A.B.C.
with nozzles 3 feet from centre of rotation

A.



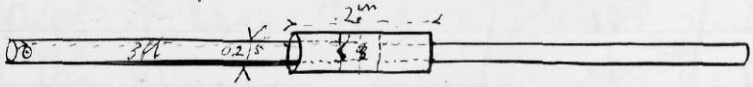
Diam of pipe 0.75"
" " nozzles 0.05"

B.



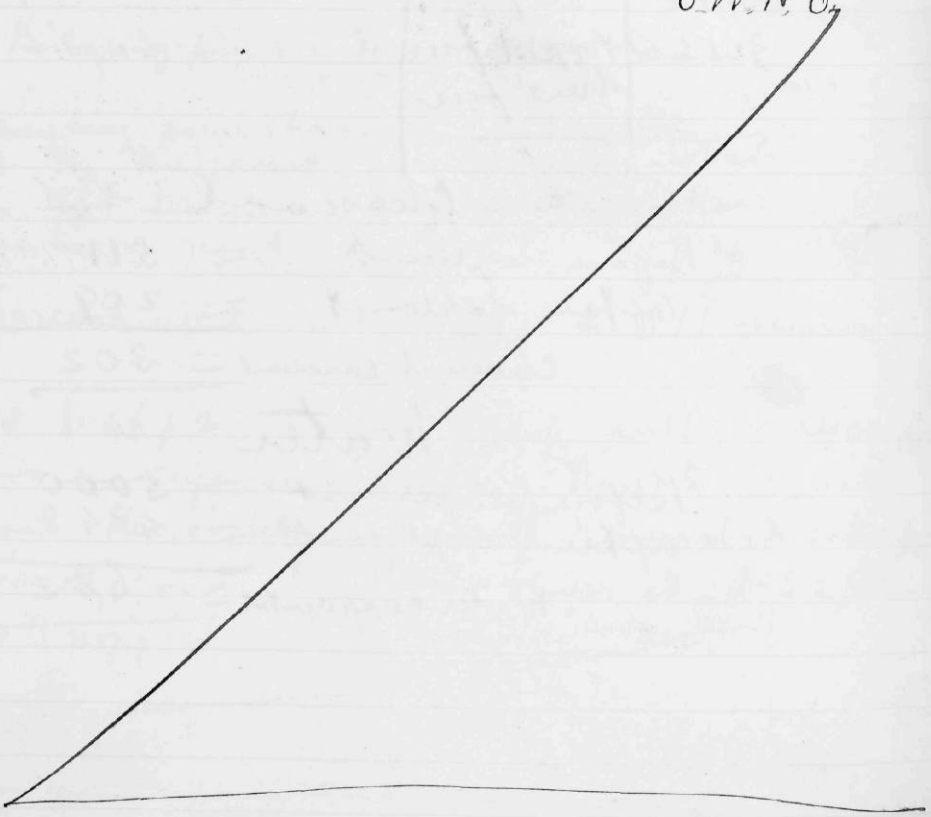
Diam of pipe 0.50"
" " nozzles 0.05"

C.



Diam of pipe 0.25"
" " nozzles 0.05"
Length of coupling 2.00
Diam " " 0.50"

E.W.P.E.



1892 Sept. 12th Monday at B.B. Lab.

Expr 1 With pipe A. Page 146. B.B. Lab R.M.

Weight of boiler + pipe 425.8 grams

" " " " " and water 500.0 grams

Weight of fire box 200 grams

" " " " and Alcohol 400 grams

Rotations per minute at 2 inc Fire started at 3.26

Steam at 3.29

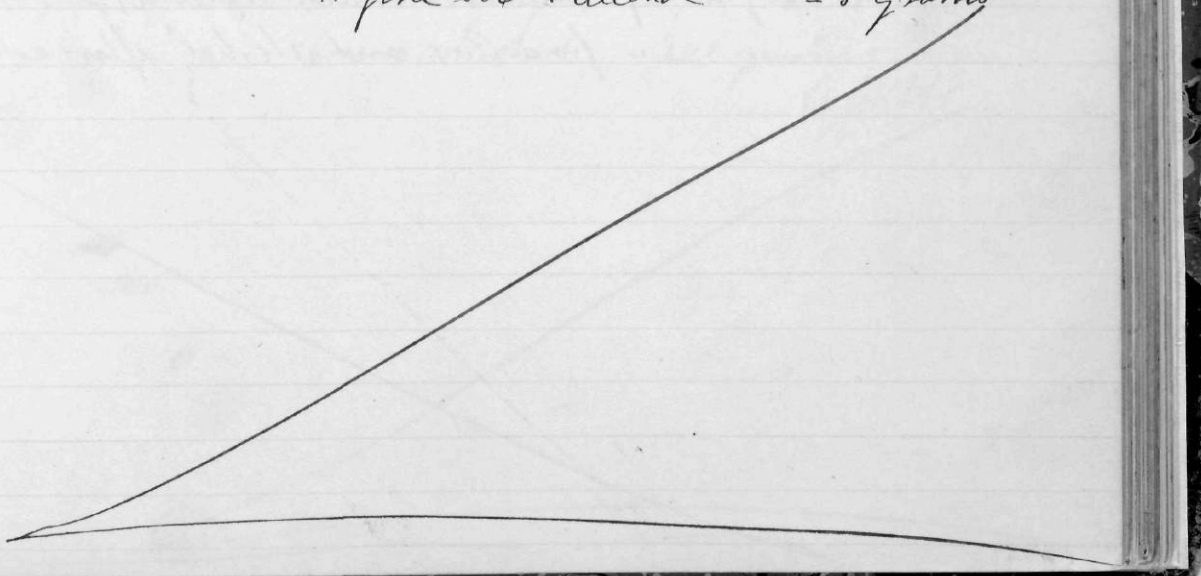
1	"	"	"	"	3.30 - 32
2	"	"	"	"	3-31 - 34
3	"	"	"	"	3-32 - 36
4	"	"	"	"	3-33 - 36
5	"	"	"	"	3-34 - 39
6	"	"	"	"	3-35 - 40
7	"	"	"	"	3-36 - 40
8	"	"	"	"	3-37 - 40
9	"	"	"	"	3-38 - 39
10	"	"	"	"	3-39 - 40
11	"	"	"	"	3-40 - 40
12	"	"	"	"	3-41 - 39

Pipe 0.75" diam

nozzle 0.05" "

Weight of boiler + ~~Alcohol~~ Water after expr 455.3 grams

" " fire box + Alcohol 230 grams



1892 Sept 12th Monday at B.B. Leak.

Expr 2 With pipe B. page 146

Weight of boiler and pipe 4040 grams

" " fine bot and Alcohol 400 grams

" " boiler + water 5000 grams

Fire started at 4-48. Steam at 4:51

Rev per minute at ~~4.51~~

1	" " " "	4.53 – 23.	
2	" " " "	4.54 – 32.	
3	" " " "	4-55 – 38.	
4	" " " "	4-56 – 42	(1)
5	" " " "	4-57 – 42	(2)
6	" " " "	4-58 – 43	(3)
7	" " " "	4-59 – 41	(4)
8	" " " "	5-00 – 41	(5)
9	" " " "	5-01 – 42	(6)
10	" " " "	5-02 – 42	(7)
11	" " " "	5-03 – 45	(8)
12	" " " "	5-04 – 43	(9)
13	" " " "	5-05 – 40	(10)
14	" " " "	5-06 – 32	42-1

Weight of boiler + water after expr 4386 grams

" " fine bot and alcohol after expr 209 grams

1892 Sept. 12th Monday at B.B. Lab

Expr 3d With pipe C. page 146.

Weight of boiler + pipe 3830 grams

" " boiler and water 5000 grams

" " fire box + alcohol 400 grams

Fire started at 8-10 Steam at 8-13

Rev per minute at

1	"	"	"	"	8-15 - 58
2	"	"	"	"	8-16 = 53
3	"	"	"	"	8-17 - 55	1
4	"	"	"	"	8-18 - 60	2
5	"	"	"	"	8-19 - 64	3
6	"	"	"	"	8-20 - 62	4
7	"	"	"	"	8-21 - 57	5
8	"	"	"	"	8-22 - 51	6
9	"	"	"	"	8-23 - 47	7
10	"	"	"	"	8-24 - 52	8
11	"	"	"	"	8-25 - 51	9
12	"	"	"	"	8-26 - 52	10
13	"	"	"	"	8-27 - 53	5.5.1
14	"	"	"	"	8-28 - 47	

Agg 4 Lab. 14/92

Weight of boiler + water after expr 3835 grams

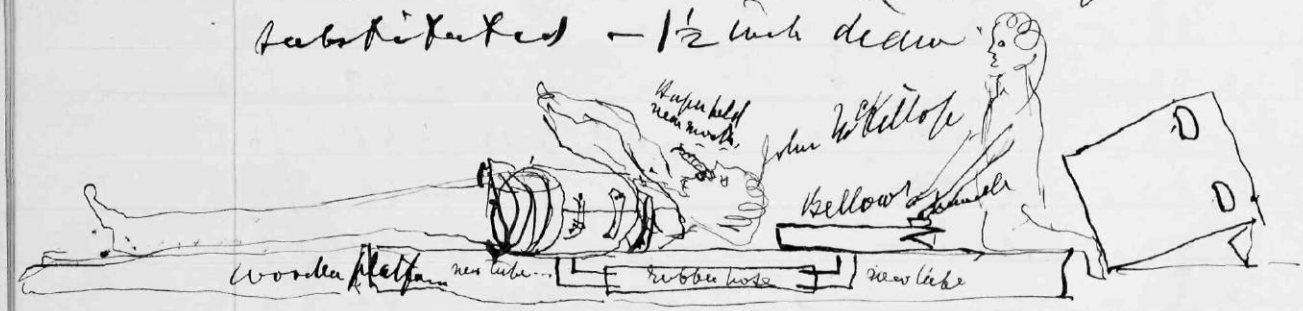
" " fire box + alcohol 206 grams

C W M E

1892 Sept. 14 — Wed — at Wds. Lab.

Exp. 1

Old ~~Brass~~ Vacuum jacket made in England for me — many years ago — and removed by W. McClean from Prof. Yeo — of King's College — London — has been put in order for trial. Brass pipe attached seemed to have too small diameter — so it has been removed and larger tube substituted — 1½ inch diam.



John McKillop submitted to experiment — seemed to succeed perfectly. W. Ellis worked bellows. John McKillop stated that he made no effort to breathe — yet a piece of paper was moved to and fro when held in front of his mouth — as the bellows was moved up and down. Paper was moved by air alternately going in and out from the mouth.

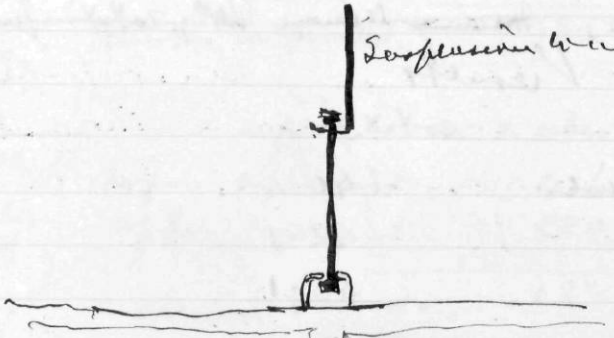
Photographic Negative # LC-G9-20511-B

After some slight modifications we propose to drown a sheep. Should we succeed in resuscitating it — the poor creature may die a natural death on Bein Bhreagh — as it will thus have earned that right & title — as long as she can.

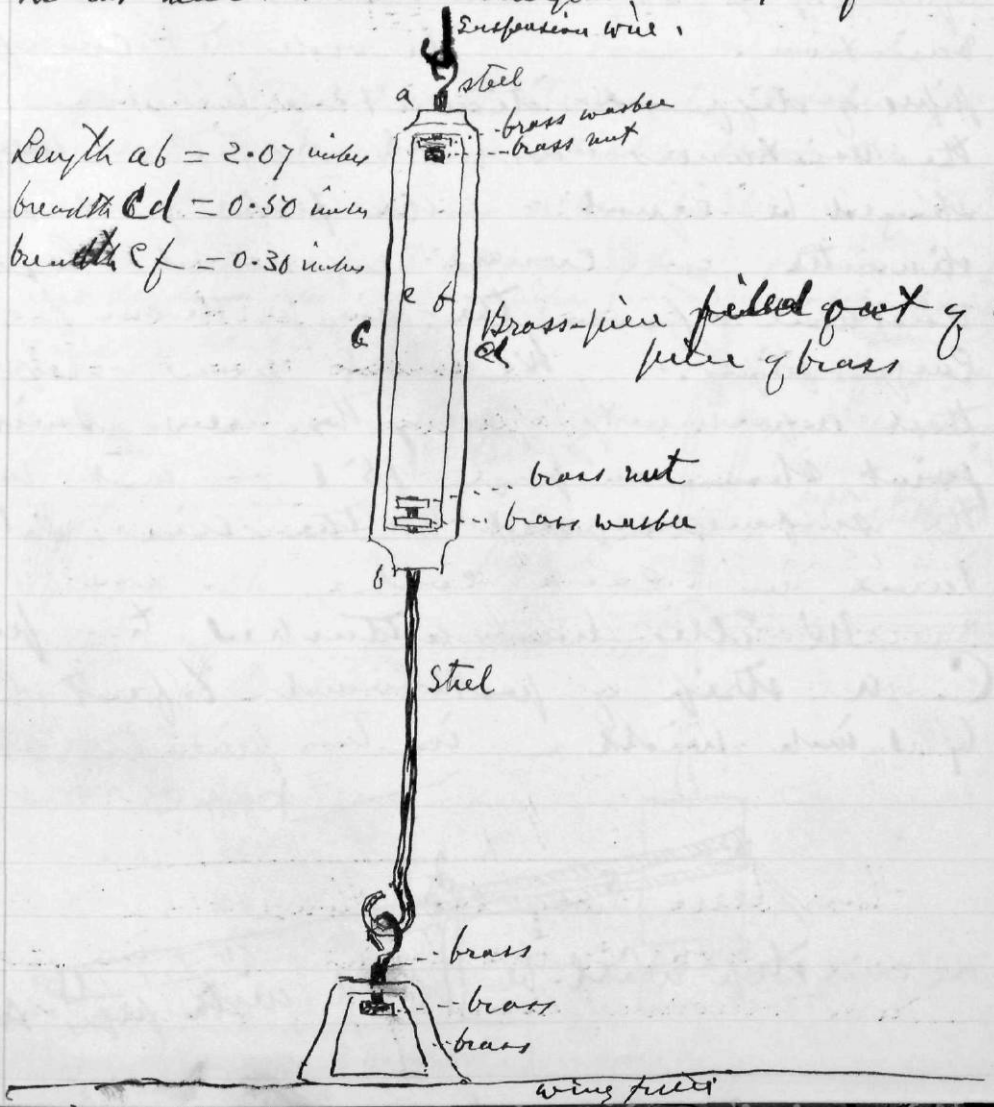
Have been away on House-boat at Little Narrows — have come home for the day — return tomorrow (Thursday) by Steamer Marion.

1892 Sept. 14 — Wed — at BB. Lab.

Before I left I gave instructions to Mr. Gilles to make a double swivel for supporting wing-piece &c — somewhat as follows: —



He has made swivel arrangement as follows:



1892 Sept. 14 — Wed — at B.B. Lab.

Results of Mr Eller's experiments with pipes A, B, C, page 146.

~~A diam. Of pipes. Mean Average No. of rotations per min.~~

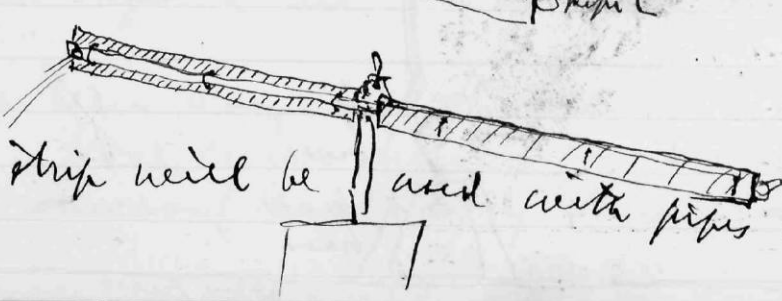
Results.

Pipe.	diameter	rotat. per min.
A	0.75 inch.	40.0
B	0.50 "	42.1
C	0.25 "	55.1

Think these results are reliable from the regularity of the rotations — not much variation.

Exp. 2. In order to compare pipes of different diameters however — the resistances as well as the weights should be equal. The pipes of smallest diameter of course experienced less resistance from the air — than the larger pipes. We will now repeat these experiments using the new swivel-joint shown on page 151 — and making the surface exposed to the air the same in each case.

W. Eller has attached to pipe C. a strip of pasteboard 6 feet long by 1 inch wide — in two pieces as shown.



The same strip will be used with pipes A & B.

Exp 2 (Pipe C) Wing-piece boiler xc.

1386
1386
908
200
100
20
10
5
4015

Before experiment.	5000 grammes
After experiment.	4015
Water evaporated.	985

Fire-box & alcohol.

(Tin jacket or cover not used.)

Before experiment.	400 grammes
After experiment	220
alcohol burned.	180

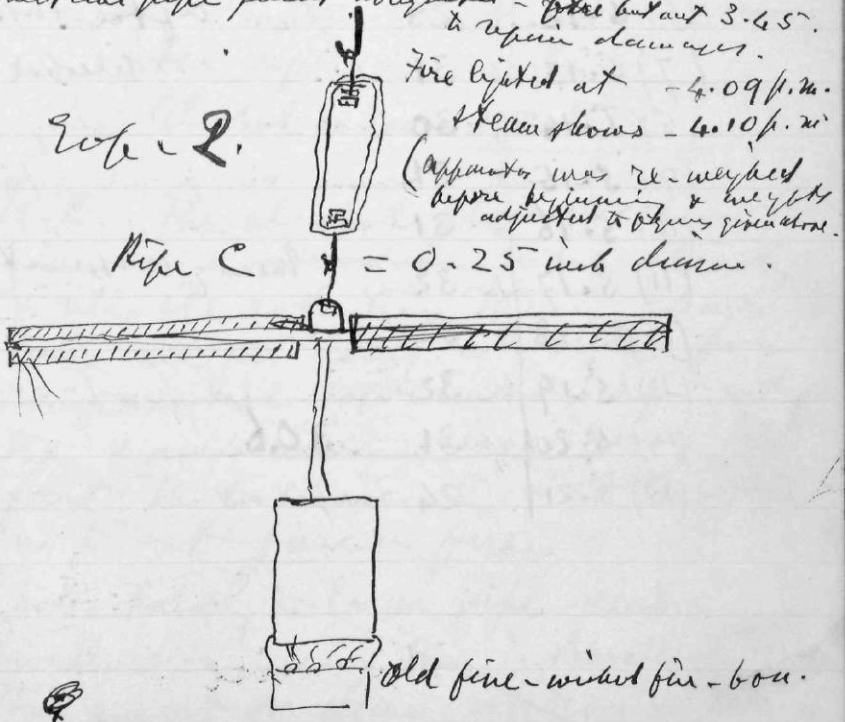
In all our experiments water is put into boiler so as to save alcohol. Water is always filtered through muslin gauze to prevent entrance of particles large enough to choke nozzles — when boiler is filled.

Fire lighted at 3.40 p.m. Steam shows 3.43 p.m.
Leak developed where vertical pipe joins horizontal — boiler out at 3.45.
& repair damages.
Fire lighted at — 4.09 p.m.
Steam shows — 4.10 p.m.
(apparatus was re-weighed before beginning & weights adjusted & observers given notice.

Time	Watt.
4-11 p.m.	26
4-12 p.m.	33
4-13 p.m.	36
4-14 p.m.	36
3 4-15 p.m.	35
4 4-16 p.m.	36
5 4-17 p.m.	35
6 4-18 p.m.	36
7 4-19 p.m.	35
8 4-20	36
9 4-21	35
10 4-22	34

Mean of 10 observations 35.4 cal. per min.

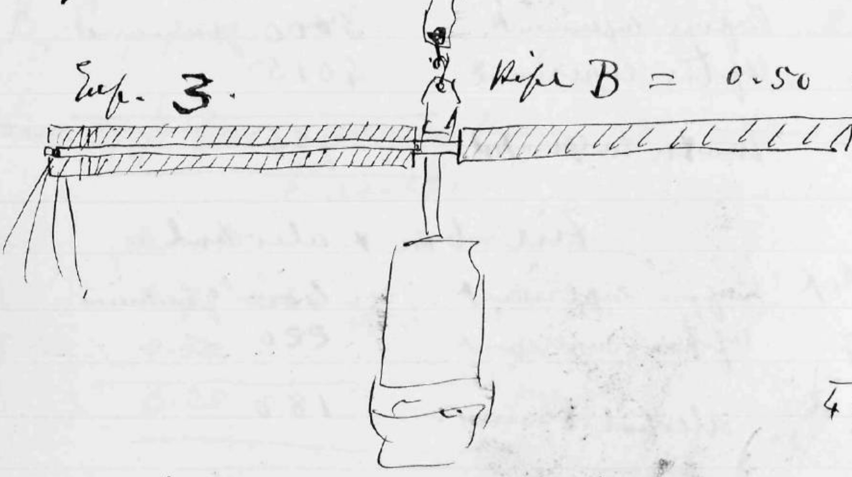
Note 2.



 1892 Sept. 14 — Wed — at B.H.'s [?] Lab-

Exp. 3 Fire lighted at 5.04 p.m. Steam shows 5.05

Exp. 3. Pipe B = 0.50 inch diam.



1386
1386
908
500
200
50
4430

	Time		rot.
	5.06 p.m.		25
(1)	5.07		28
(2)	5.08		29
(3)	5.09		26
(4)	5.10		26
(5)	5.11	1	28
(6)	5.12	2	28
(7)	5.13	3	31
(8)	5.14	4	30
(9)	5.15	5	31
(10)	5.16	6	31
(11)	5.17	7	32
(12)	5.18	8	32
(13)	5.19	9	32
(14)	5.20	10	31 — 30.6
(15)	5.21		24 Fire put out.

Boiler [?]

Before caps.	5000
After caps.	4430
Water evap.	570

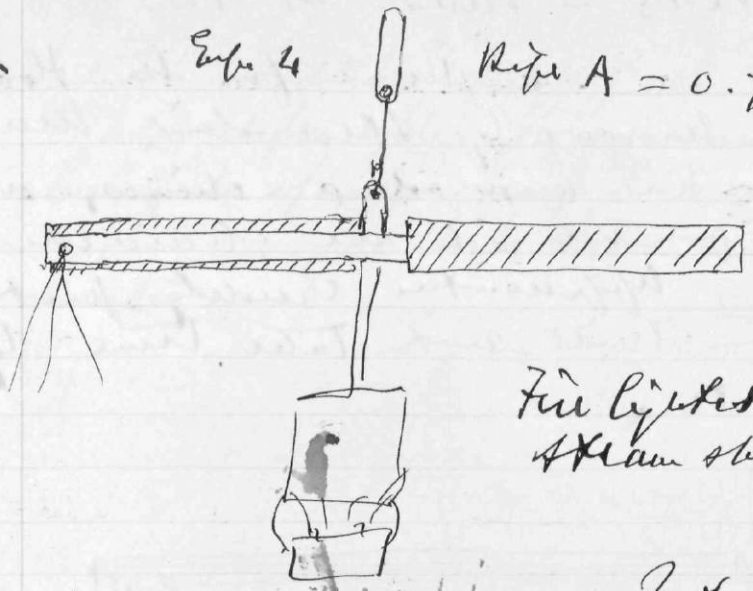
Fire-box.

Before caps.	400
After caps.	205
Alcohol consumed =	195

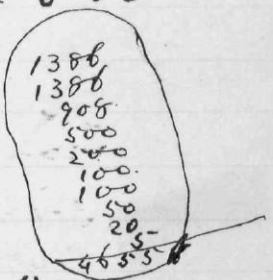
Mean of 10 observations = 30.6 rot. per min.

Exp. 4

Exp 4 Pipe A = 0.75 inch diam.



Fire lighted at 5.59 p.m.
Steam shows at 6.00



Notes.

Boiler.
Before exper. = 5000 grammes
after exper. = 4655
water evap. = 345 grams

Fire-box
Before exper. = 400 grammes
after exper. = 225
Alcohol consumed. = 175

Time	rotations per min.
6.01	24
6.02	24
6.03	26
6.04	27
6.05	27
6.06	26
6.07	25
6.08	25
6.09	25
6.10	22
6.11	21
6.12	19
6.13	21
6.14	24
6.15	26
6.16	Fire put out

Mean 10 obs. = 25.1 rotations per minute.

N.B. The alcohol flame seems to give us a ~~steadier~~ more steady & reliable rotation than charcoal hence we are using alcohol for comparative experiments — at the same time recognizing the fact that charcoal will enable us to get fiercer fire.

N.B. Probably in larger pipe greater Condensation occurs than in smaller - this may account for slower rotation — whizzing sound heard after now and then — when water was ejected — (thick) — as well as steam.

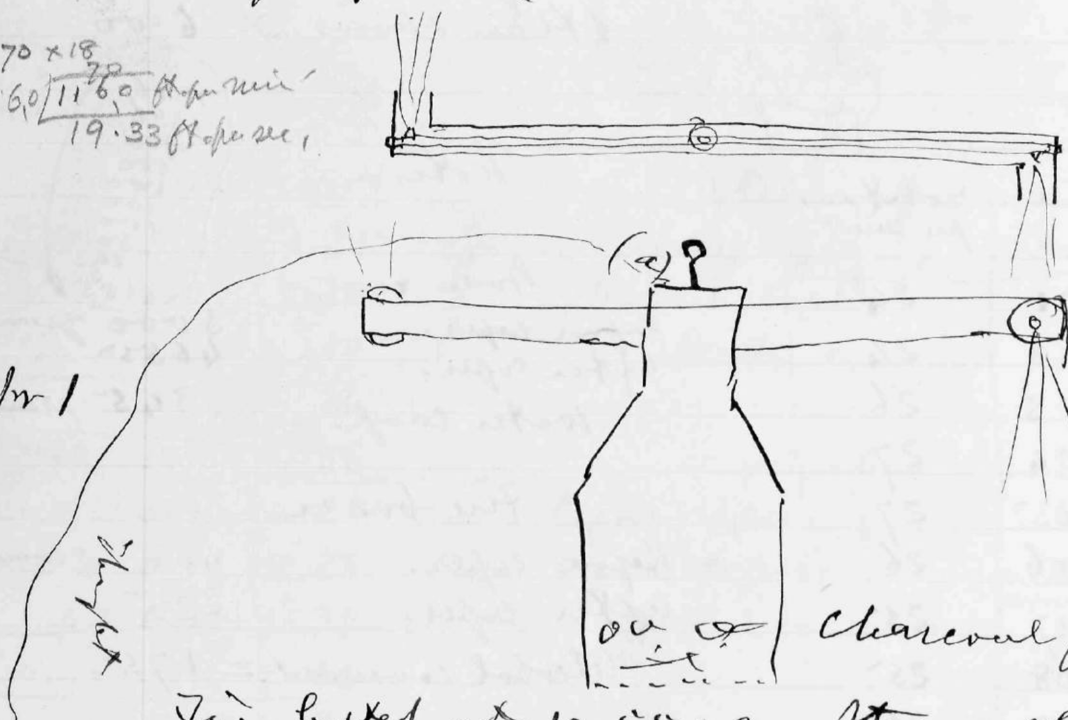
1892 Sept. 15 — Thurs. at B.B. Lab.

I leave in about an hour for the House-boat at the Little Narrows by steamer Marion.

Mr. Ellis has arranged a chimney arm experiment for me — to see character of effect. Apparatus crudely put together — will not take time by weighing &c.

70 × 18
6,0 | 11 6,0 ft per min
19.33 ft per sec,

Expt 1



Fire lighted at 10.55 a.m. Steam [illegible] at

Time	rotations	notes
11.09	38	Difficult to start — but at 11.08 was in good rot.
11.10	45	
11.11	51	
11.12	54	
11.13	60	
11.14	62	
11.15	69 more	
11.16	70	

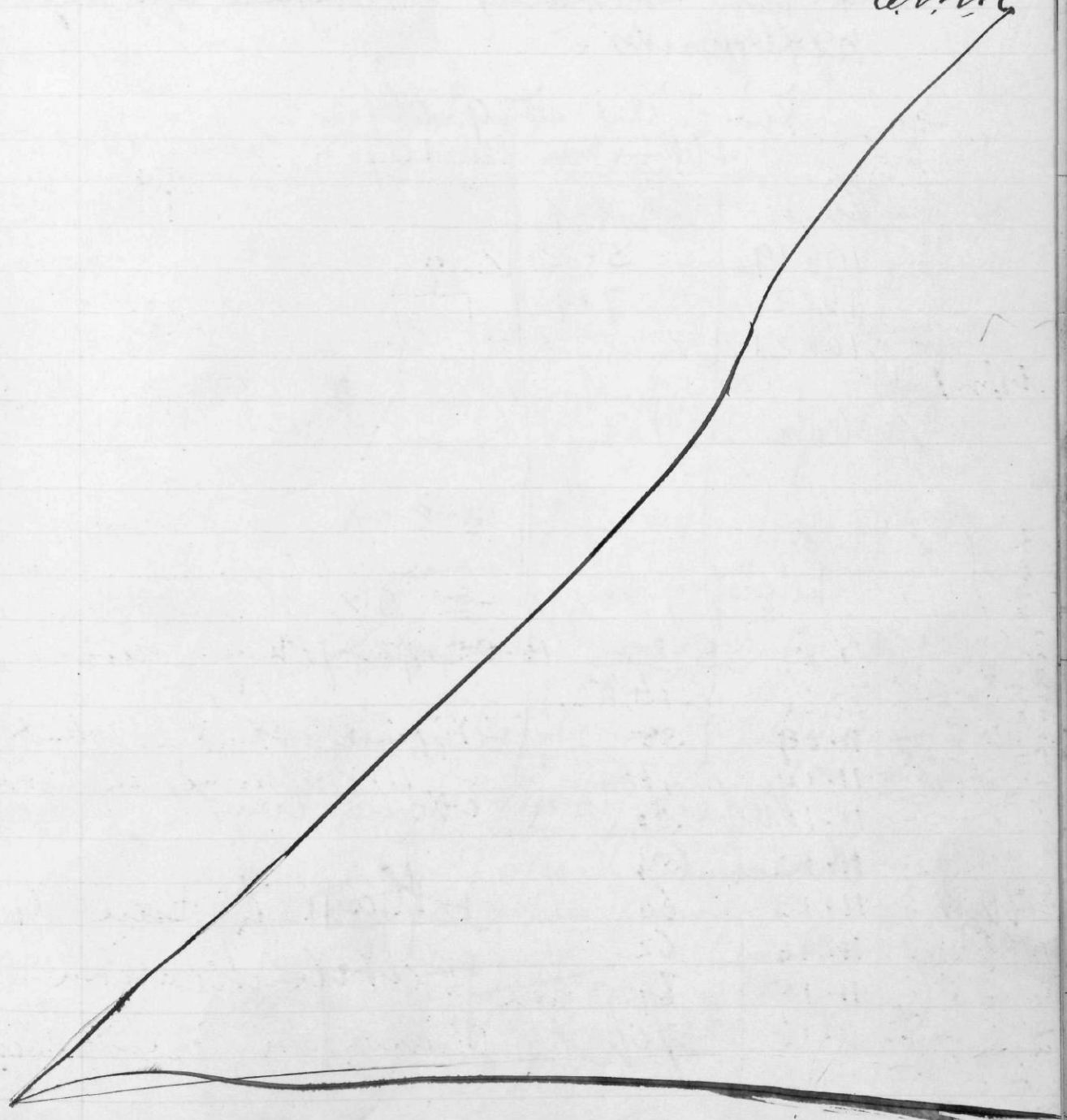
Have to run to catch Marion

Chimneys a great success.

Left tube (a) open until steam started then closed tube & steam went on rotating & sustain draught & rotating it.

AGB Sept 15 '92

1892 Sept-16th Friday at BB Lab.
Water left after experiment, see P. 156. = 382 grms.
Contents of new ring boiler. = 1254 grams.
" " old tube boiler. = 1361 grams, of water.



1892 Sept. 21 — Wed. — at Bk. Lab.

Exp. 1. New chimney winged arrangement ready for trial — ~~[illegible]~~ diam. of wing piece 12 feet — cannot try in Lab. building — so have taken to the Boat-house — will note results & note details of ~~[illegible]~~ apparatus afterwards.

Fire lighted at 9.56 p.m.
Steam shows 10.10 p.m. moving 10.15

Time	rotat
10.19	5.2
10.20	7.9
10.21	

Seven seconds per rotation

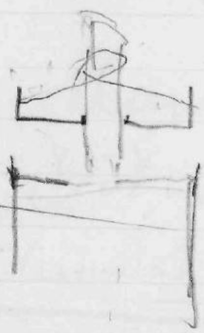
Fire put out at 10.25 as the charcoal about gone out

$7 \overline{)60} = 8.5$ $36.8 \times 8 = 288$ At 8 rot. per min

Velocity of nozzle = 8 × 36 = 288 ft per min.
= 4.8 feet per second

$6 \overline{)28.8} = 4.8$

Repeat tomorrow with more charcoal.

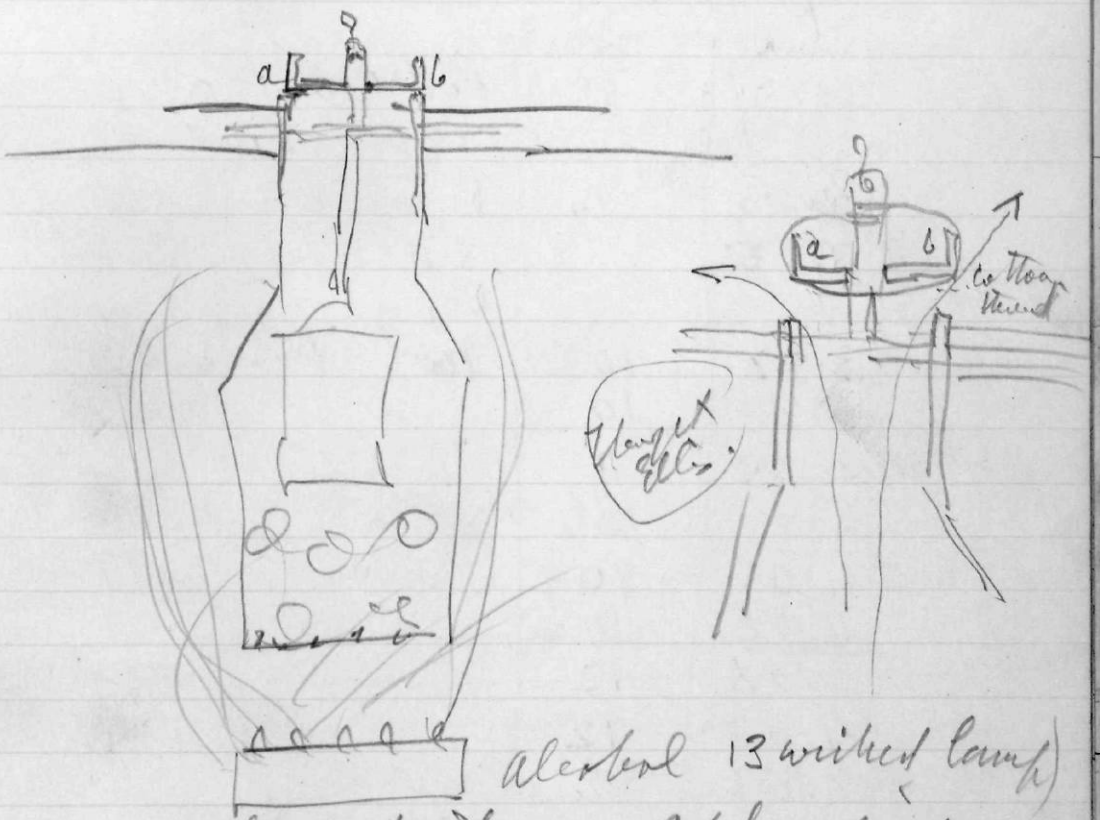


Sept [illegible]

[illegible signature]

1892 Sept. 21 — used — at WS Lab.

Trouble with apparatus over that cap to chimney top was closed — so that there was no draught through channel till steam started — by which time charcoal had almost burned away under action of alcohol flame



Flame chiefly outside — splendid alcohol blaze — but no draught through fine as lid (ab) was shut.

Hood flue

Hasten lid (ab) open & cotton string — which will burn away when flame reaches it through proper channel — When this happens proper time has come to close it as draught will be sustained by steam jet & rotation.

Noted at WS Lab — Sept. 21 — 1892

AJL

1892 Sept. 22 – Thursday at Phy Lab.

Exp. 1 – Everhardy's expr. repeated with Lounge charcoal box – + chimney lid tied up with string.

Fire lighted at 3.07 p.m. Steam shows 3.30
Lid ~~drops at~~ shut at 3.31 – Fire not good –
rotation starts at: ——

Time	rot.	
3.52 p.m.		Lid opened again – steam at once improves.
3.54		begins rotating.
3.56		Lid closed again – seems to go on rotating.
3.57	10	rotations per min
3.58	10	" " "
3.59	9	" " "
4.00	$10\frac{1}{2}$	" " "
4.01	$10\frac{1}{2}$	" "
4.02	$10\frac{1}{2}$	" " "
4.04	12	
4.05	12	
4.06	Fire drawn	

Experiment not satisfactory – should have left lid open as suggested at first – Must repeat experiment.

Boiler &c –
Before exp. – 6882 grammes
after exp. – 6319

Water evap. = 563

1892 Sept-22- Thursday - at W.H. Lab.

Exp. 2 Water boiler &c ——— = 6500 grammes

Small alcohol lamp (5 wicks) used to start fire. Fire lighted at 5.15 p.m. Steam at 5.23

Rotation begins 5.24 —

Time	rot
5.28 p.m.	9½
5.29	12
5.30	14½
5.31	16½
5.32	18
5.33	20
5.34	21
5.35	21
5.36	21
5.37	20
5.38	20
5.39	Stopped; Steam suddenly gave out.

$$\begin{array}{r|l} 6 & 72.0 \\ & .20 \\ & 36 \end{array}$$

12 ft per second.

Exp. 3 Same engine repeated with full water supply — full charcoal — & lid lifted; fire lighted at 9.12 — 9.26 = compact & fire — low red — hot & steam blowing

Time	rot. per min.	Time	rot.	Time	rot
9.30	10	9.35	14	9.40	17
9.31	9	9.36	14	9.41	18
9.32	13	9.37	15	9.42	18½
9.33	14	9.38	15	9.43	18½
9.34	14	9.39	15½	9.44	18

Time	Revs per min	
9.45	19	
9.46	19	
9.47	20	Cut shuttle down & cutting string
9.48	16	
9.49	13 1/2	
9.50	11	
~~9.52~~	nearly stopped	~~Cut stopped open~~
9.53		Cut stopped open
9.54	11	
9.55	14	
9.56	14	
9.57	13	Steam stopped suddenly and fire at once drawn

Dear W-Elle.

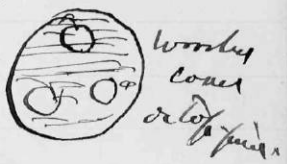
Want another Volta pile
If we can make one that will
give good effects will exhibit it
If we can't do better than last
time won't try it.

Instructions –

Make fifty disks of zinc 3 inches diameter
" 50 disks of copper 3 inches diam
" 50 disks of tin 3 inches diam.
" 50 disks of felt cloth 3 inches (under)

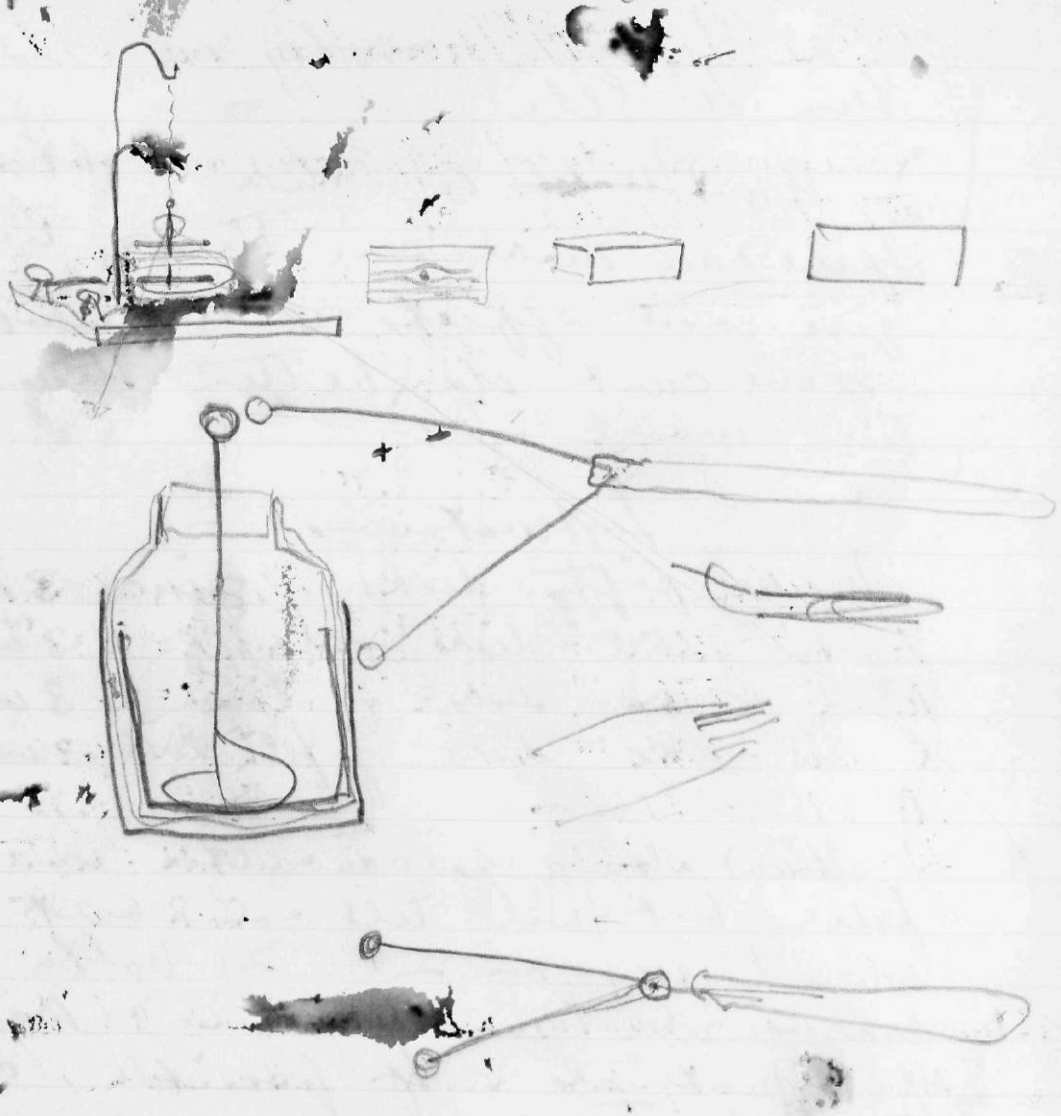
Want also a galvanometer and Leyden
jar – but will tell you about them
when I see you – The Volta pile
may require you to go in to Baddeley's
for materials. If possible order
them by telephone – and go ahead
with what you can in Lab.

The Volta pile will want a
wooden stand



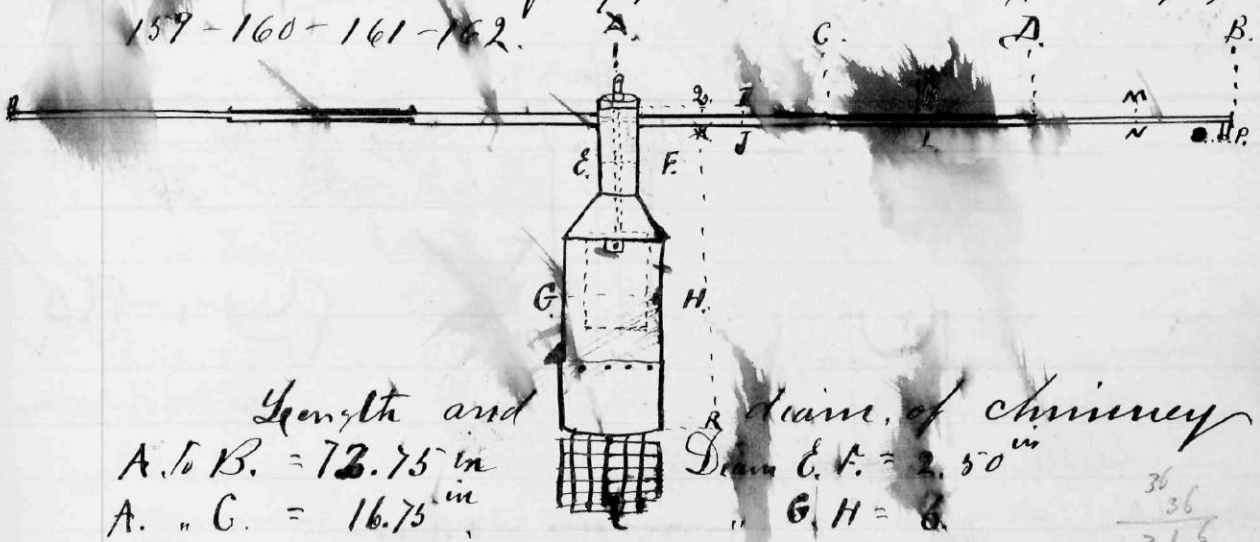
agb

1892 Sept. 26 - Mounting - at BB. Lab.



1892 Sept. 29th Thursday, at B.B. Lab

Measurements of apparatus used in exp on pages 159 - 160 - 161 - 162.



Length and Diam. of chimney

A. to B.	= 72.75 in	Diam E. F.	= 2.50 in
A. " C.	= 16.75 in	" G. H.	= 6.
C " D	= 34. in	" I. J	= 0.95
A " B	= 21.80 in.	" K. L.	= 0.75
D " R	= 24.75	" M. N.	= 0.65
		" O. P.	0.95

36 36 216 108 1296

Exp. 1. Same apparatus with different chimney.

Weight of wing-piece, boiler + water = 5916 gms

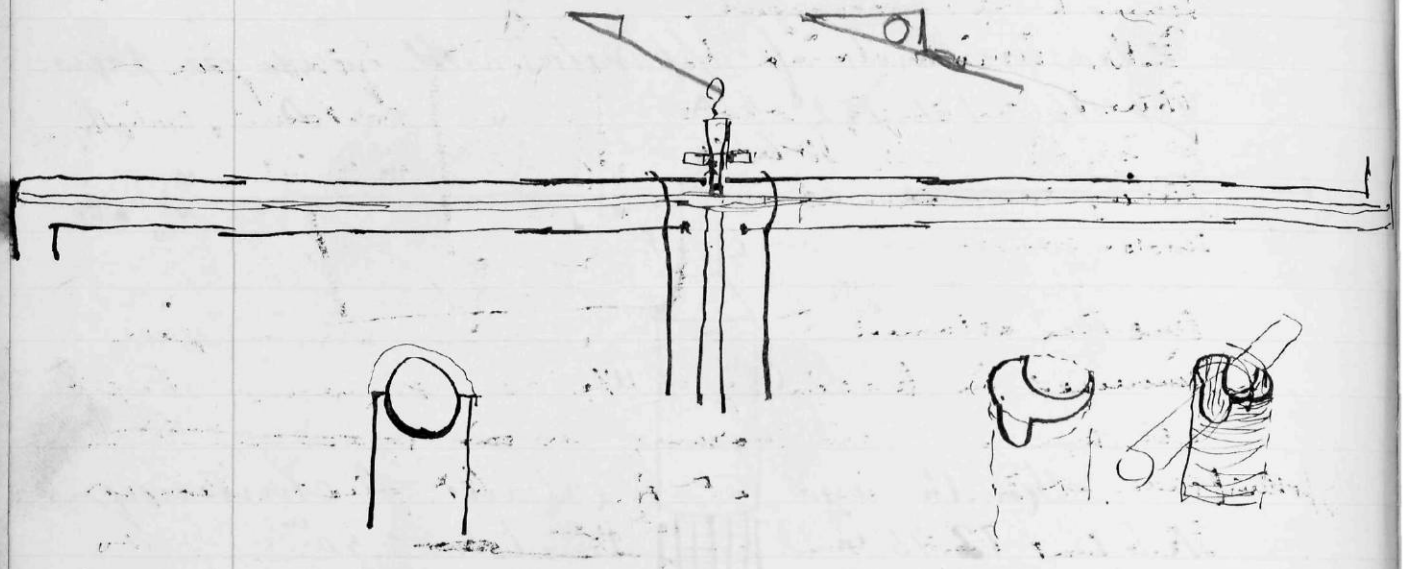
1386 1386 1386 908 500 200 100 50 5916

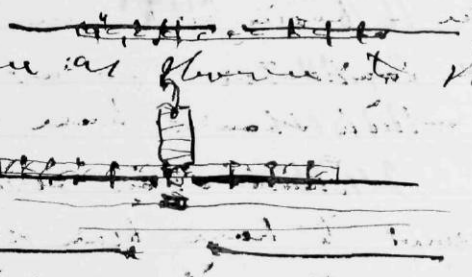
Fire lighted at 3.22 p.m. steam shows 3.31 p.m.

3.38 p.m.	15 rot.	3.47 p.m.	36 rot (2)	3 rot.	
3.39 p.m.	19 rot.	3.48 p.m.	36 rot (3)	Mean = 5 rot.	
3.40 p.m.	22 rot.	3.49 p.m.	35 rot (4)	Product = 36 rot.	
3.41 p.m.	26 rot.	3.50 p.m.	36 rot (5)	per min.	
3.42 p.m.	29 rot.	3.51 p.m.	35 rot.	36 × 36 = 1296 ft per min.	
3.43 p.m.	31 rot.	3.52 p.m.	35 rot	1296 ft per min.	
3.44 p.m.	33 rot.	3.53 p.m.	33 rot.	21.6 ft per sec.	
3.45 p.m.	35 rot	3.54 p.m.	32 rot.		
3.46 p.m.	37 rot (1)	Fire drawn			

5916 4758 1158 (work done per min.)

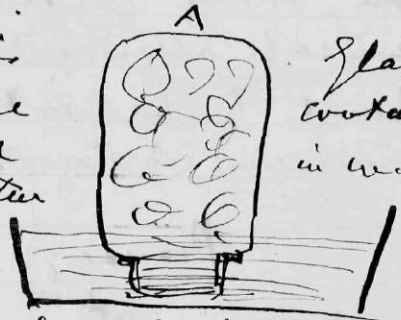
1386 1386 1386 500 100 4758





Yesterday's experiment in canning cauliflower seems to be successful.

N.B. Curious point is there is no empty space at top (A) of liquid. Whole thing was screwed together under water at nearly the boiling temperature.



Glass jar — containing cauliflower in water.

And then allowed to cool with neck of jar immersed in basin of water as shown. Left all night. This morning no space at top of liquid at A.

Hypothesis 1. At first thought I imagined that cover had not been air-tight so that water of basin had been drawn into jar when liquid inside contracted — so as to make good the vacuum which should have been apparent upon cooling. Examination seemed to show that rubber cover seemed to have been screwed down on rubber ring so tightly that it seemed to be impossible for water (or air) to make its way inside.

Hypothesis 2. Perhaps cauliflower has expanded sufficiently to prevent formation of empty space.

Exp. 1. Cover was tightened as much as possible — and jar & contents immersed in water @ 100° F. Left there for some minutes.

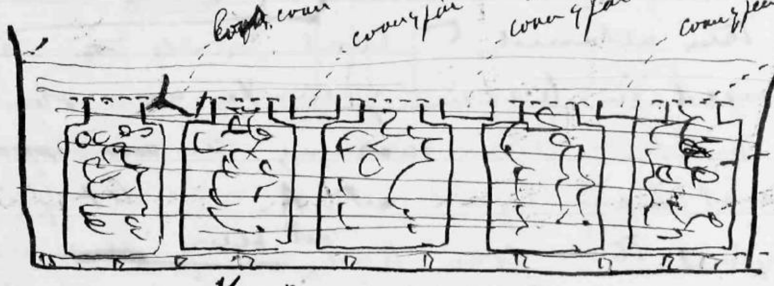
Result. Jar did not burst — jar now cooling in air upside down. Think 2nd. hypothesis true explanation — Cauliflower expands & contracts sufficiently to accommodate pressure — & prevent formation of empty space. No leak —

 1892 Oct. 4th - Tuesday - at Bkft. tab.

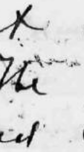
Might of

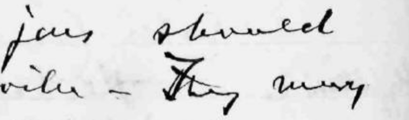
Why should it be necessary to screw cover on while water is boiling? Water might be allowed to cool sufficiently to permit hand to be introduced and cover then screwed on by hand.

Process of Canning vegetables &c

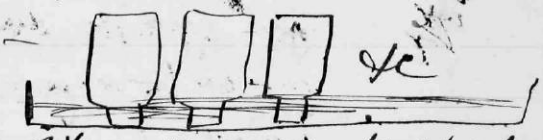


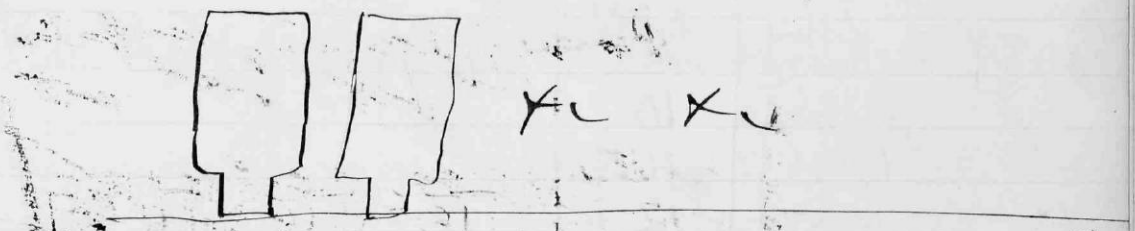
Now boil for some time - ad lib - but surface of water in boiler must be ~~from~~ at least one or two inches above top of jars. The covers for the jars should also be boiled in the same boiler - They may be left lying about loose in water.

Now allow whole arrangement to cool sufficiently to permit hands to be inserted in water without scalding. Insert hands - pick up a cover and without letting any air into it, hold it over the top of one of the jars while with the other hand the metallic grating is slipped upon one side. Then screw cover on under water - and turn jar upside down.  If no air-bubbles appear, jar is O.K. Then repeat process with other jars.



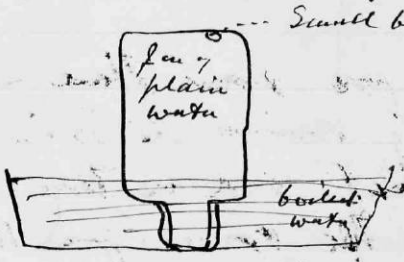
Let them stand upon trays with inches of water that has been boiled — & cooled. Give final tightening to covers — and store away — keeping jars always upside down.





Open next year when vegetables are scarce!!

Exp. 2. In order to test hypothesis 2. p. 167 — a jar has been prepared without any cauliflower in it.



Small bubbling air shows at ~~bottom~~ top of liquid. Apparent now cooling. Will air bubble increase materially in size?

No — it has diminished in size. ... Cover jar quite loose — have screwed it tight under water.

Have now turned jar right way up — and shaken it — Have left it for some time right way up. Upon removing bottle as shown above — air bubble no bigger than before

N.B. The jar with cauliflower — I stood upright for a moment — upon then removing it — some large bubbles of air ascended to top of liquid — Found cover could be screwed tighter — Felt rather uncertain about air-tight cover — Jar must be kept upside down.

1892 Oct 4 - Sunday at BB. Lab

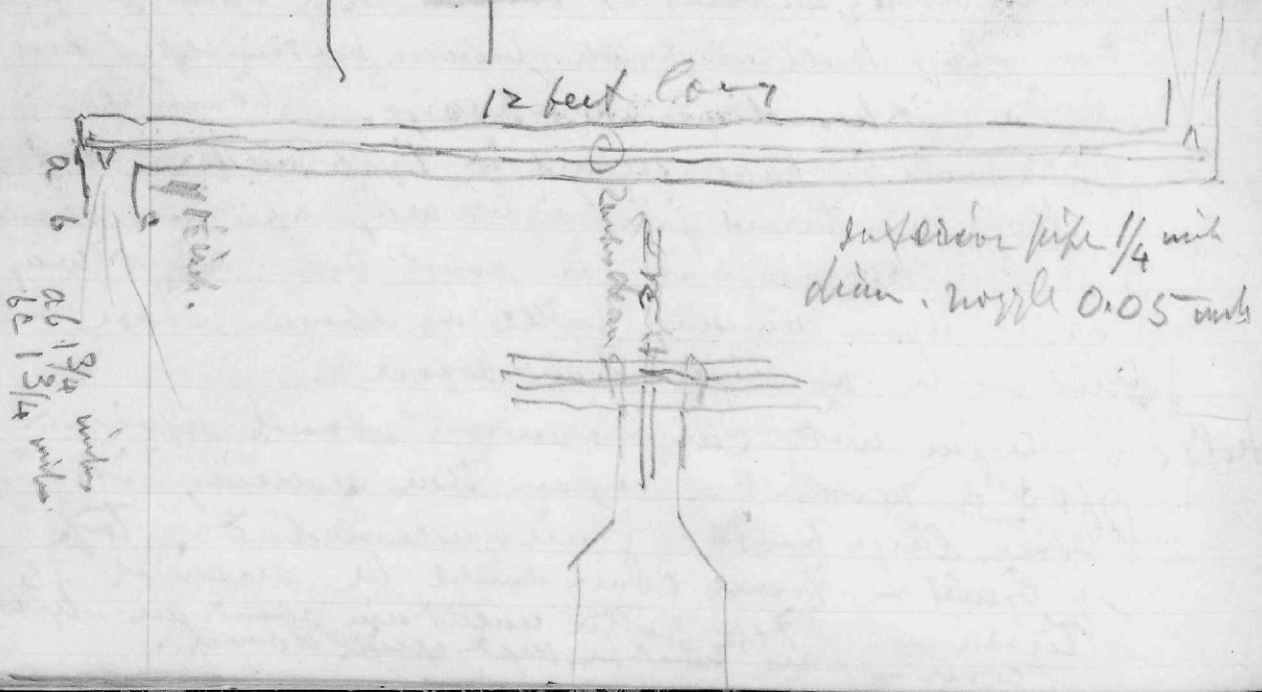
Exp 13

Fire lighted 10.15 p.m.
Smoke coming out of brown chimney
arm at 10.27 p.m. Good draught,
Steam shows at 10.30

Time	rev.
10.35 p.m.	10
10.36	10 ½
10.37	12
10.38	13
10.39	14 ½
10.40	15
10.41	15
10.42	15
10.43	15
10.44	15
10.45	15
Fire drawn	

15 × 12 × 3 =
36
15
180
36
60 | 540 ft. per min.
9 ft per sec.

Weight of boiler + charge
7304 grams



Exp. 4. Will now repeat experiment 3 with projecting ends of chimney removed —

Fire lighted 11.28 p.m. Steam shows 11.37

Time	Revs
11.40 p.m.	9
11.41	12
11.42	14½
11.43	16
11.44	16½
11.45	17
11.46	17½
11.47	17
11.48	18
11.49	19
11.50	18
11.51	17
11.52	17
11.53	16½

Fire drawn

19 5
36
114
57
60 | 684 ft. per min.
11.4 ft. per rev.

one nozzle screw plugged.
Steam from only one nozzle
Steam from only one nozzle

1892 Oct 5th Wednesday at B.B.

Exp 1 Jar of sweet corn, this has been boiled, and closed up, without being exposed to the air, having been left in the water until the water was cool enough to admit the hand to screw up the top

Exp 2 Fifteen jars cauliflower, manipulated the same as the corn

Exp 3 One jar Cauliflower & peas, same as before

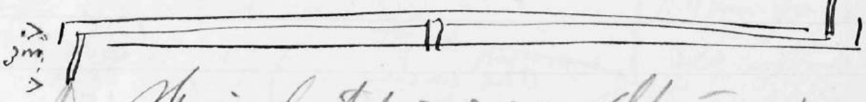
When water was cool enough to admit the hand, the tops were slipped on, while under the water, and screwed up, then the jars were turned over, and by close observation, small bubbles, were found in among the cauliflower, and other vegetables, by turning and shaking the jar the bubbles were caused to come to the top and unite, then the jars were turned top upmost - and unscrewed again, and the air escaped, then top was replaced, as at first; some of the jars were opened three times

Result - Eleven of the jars, do not show any air bubbles, while six have but a very little air in them J. H. M.

C. U. Oct 6

1892 Oct 6th Thursday at B.B.
Will now make an expr with apparatus used in Ex 4 Page 171, with long nozzles in place of short one. nozzles used are 3in long.

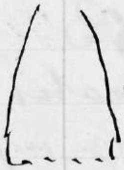
Exptn X 1



Fire lighted 3-28. Steam at 3.45

Rotations per min at						per minute
Ob 1	"	"	"	4.50	=	7
2	"	"	"	4.51	=	8
3	"	"	"	4-52	=	9
4	"	"	"	4-53	=	10
5	"	"	"	4-54	=	11
6	"	"	"	4-55	=	13
7	"	"	"	4-56	=	13
8	"	"	"	4-57	=	13
9	"	"	"	4-58	=	13
10	"	"	"	4-59	=	14
11	"	"	"	5-00	=	15
12	"	"	"	5-01	=	15
13	"	"	"	5-02	=	15
14	"	"	"	5-03	=	15
15	"	"	"	5-04	=	16
16	"	"	"	5-05	=	17
17	"	"	"	5-06	=	17
18	"	"	"	5-07	=	18
19	"	"	"	5-08	=	17
20	"	"	"	5-09	=	17
21	"	"	"	5-10	=	16
22	"	"	"	5-11	=	15

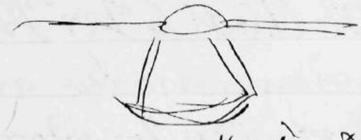
Have not so good as in expr 4) Page 171, until near the end of expr. Curious
J. H. K.



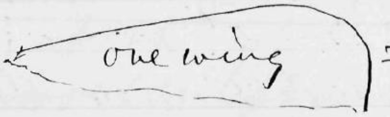
Tin
Cover
&c.

1386
1386
2772
−60
2712

1386
1386
1386
200
100
100
4558 grammes.



Boiler & short arms



= 1386
50
20
10
1466

Boiler & ~~short~~ short arms	=	4558
~~Tin~~ Tin Cover & fin ~~box~~	=	2712
Two wings	=	{1466
		{1466
Total without fire		10202 grammes.

454) 10202 (22 ½ lbs appro.
9081
1122
908
214

Mica purchased in Washington (or N.Y.?)

Mica ~~do~~ 10 sheets of mica each 4½ by 8 inches weigh 47 grammes or 4.7 grammes a piece.

$4\frac{1}{2} \times 8 = 36$ square inches of surface & this weighs 4.7 grammes.

Each square foot of mica wing-surface should weigh 18.8 grammes.

For ~~36~~ : ~~144~~ :: 4.7 : x
~~8~~ ~~12~~ 4
1 4 18.8 grammes

1892 Oct 24th Monday at B B Lab

Expt-1 To find the pressure in boiler with 0.05 nozzles

Fire lighted at 12-23

Steam at 12-34

Gage shot at 12-37 — 5 lbs pressure { Steam gage registering 2 lbs attached to boiler

" " " 12-43 — 9 lbs "

" " " 12-45 — 9 lbs "

Blowpipe and Bellows " " " 12-50 — 10 lbs "

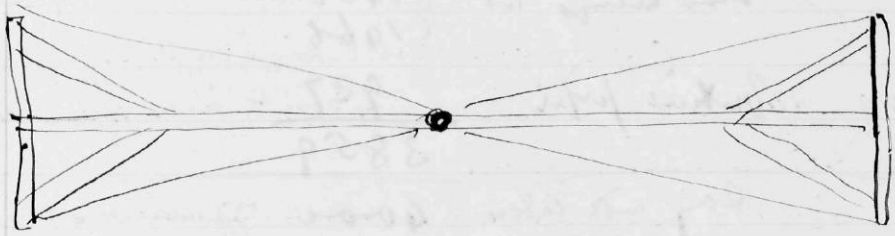
" " " 12-62 — 15 lbs "

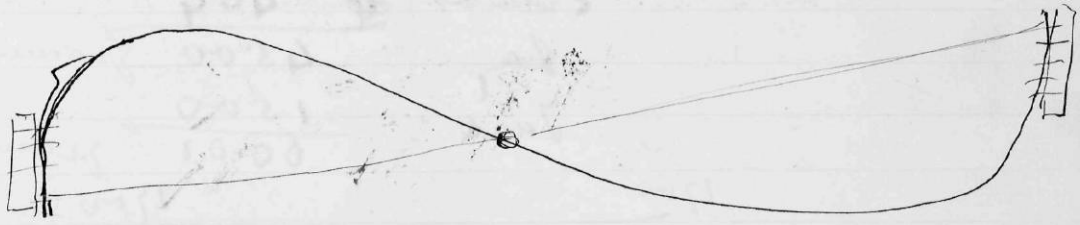
Sheet of tinned iron 4½ × 8 inches = 71 grammes.

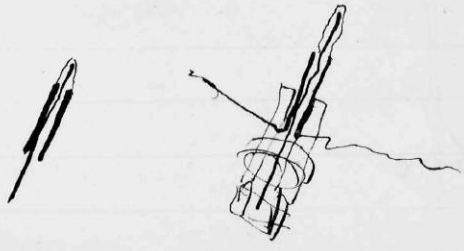
Thin sheet of mica " " " = 6

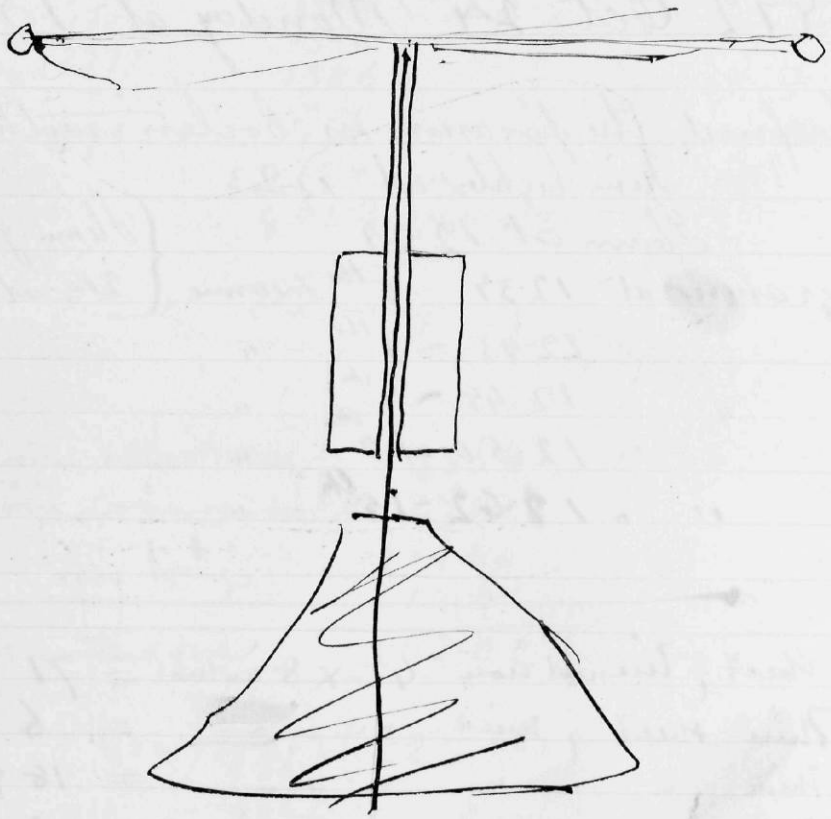
Thick " " " " " = 18 grammes

Another thin " " " " " = 3.5 grammes.









908
454

22

908
10
37
927

Two wings at £1466
£1466

Rudder piece — 927

3859

1466
227
1693

Bag with tubes 4000 grammes

2 rockets @ 454

Bag 4500 grammes

Tank 1500

6000 grammes.

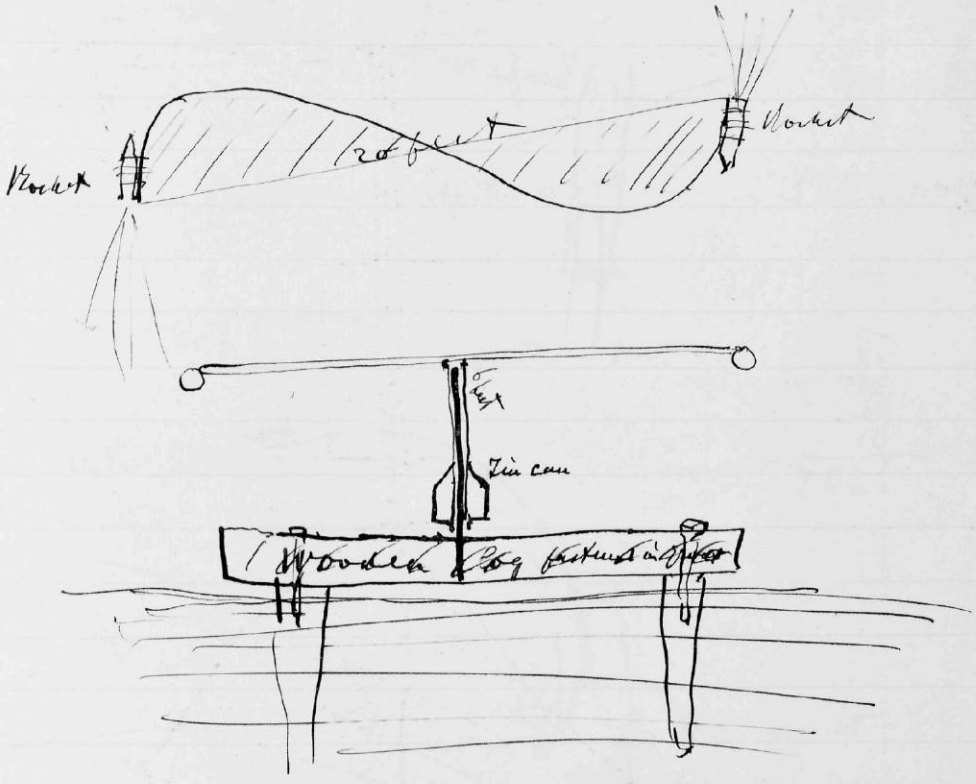
1500
927
2427

6000
3400
2600

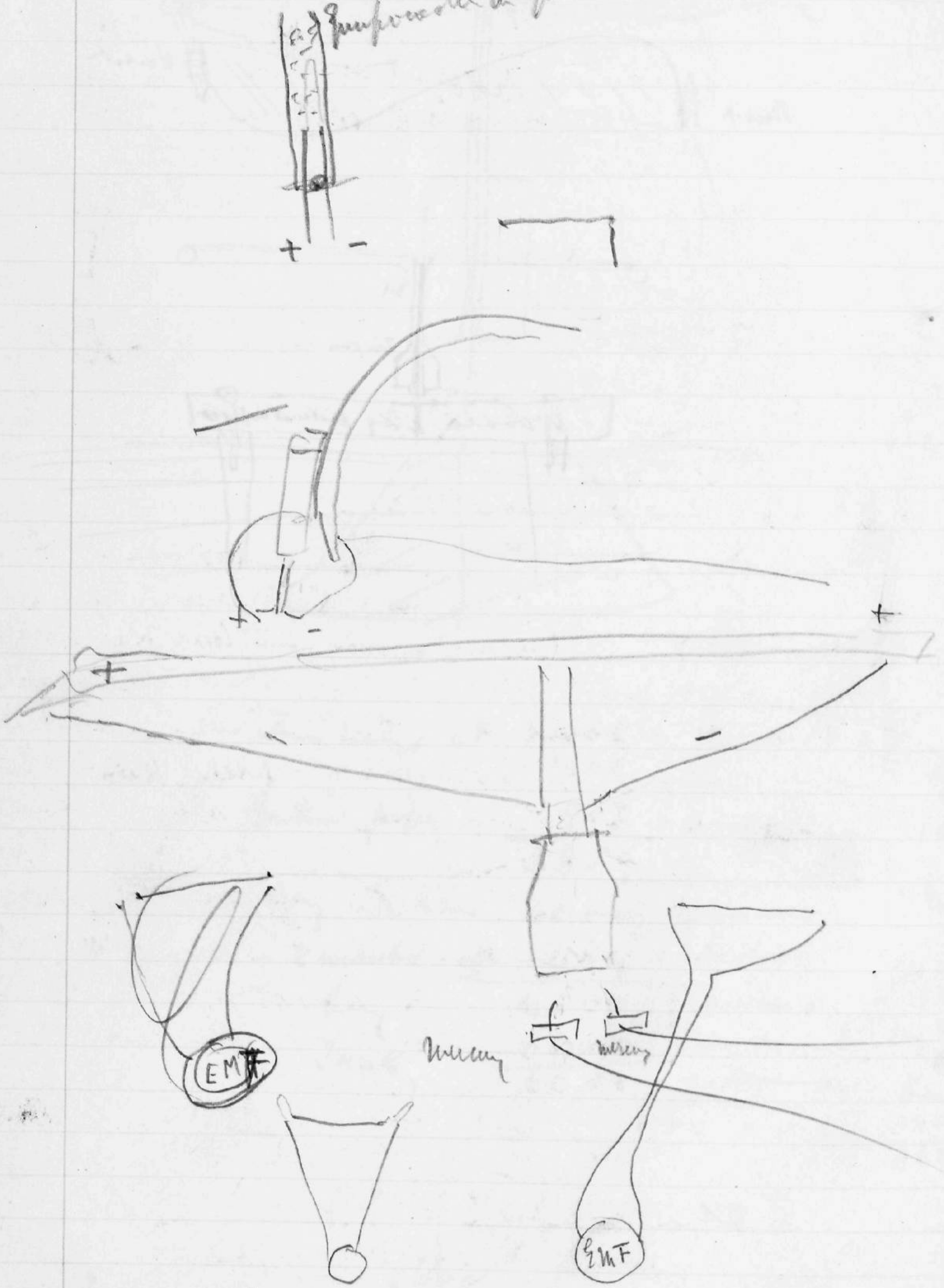
1700 1700

2600

1892 Oct. 24 – Mooring at Big Lot.

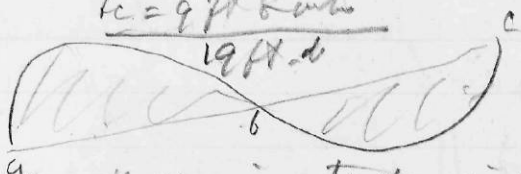


1892 Oct 26 — Wed — oct Bb feb



1892 Oct. 26 — Wed. — at WB - Lab.

ab = 9 ft 8 inches
bc = 9 ft 8 inches
19 ft 4

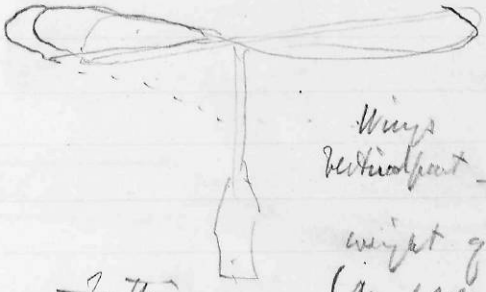


1386
1386
200
100
50

Both wings together weigh — 3122 grammes

1386
500
100
20
10
10
10

Vertical pipe & Cylinder attached — 2036

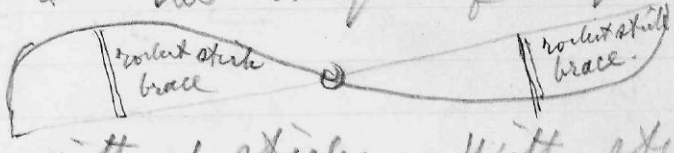


Wings 3122
Vertical part 2036
5158

To this must be added weight of two ~~Eight~~ ounce rockets (say 454 grammes with together) without their sticks and plus some stout binding wire.

~~To this~~

W. Ellis says that the rocket sticks have been used as braces in the wings - and have been added in to the weight of wings given above.



And not weigh rockets without sticks. With sticks each weighed 1/2 lb or 8 oz — So both together = 1 lb = 454 grs. Throwing off 54 grammes for sticks = rockets = 400 grs

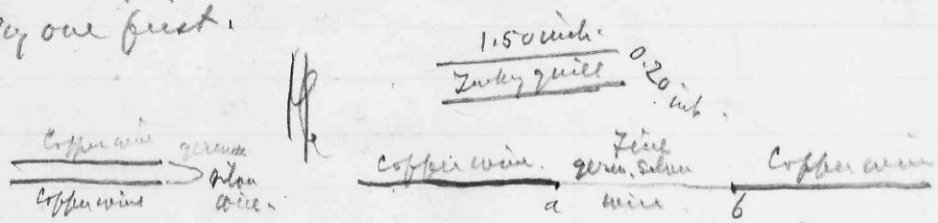
1 apparatus 5158 grammes
Rockets 400
Binding wire & guy ropes 100 grs (over estimate)
Total apparatus 5658 grammes
under 11 lbs (under 10½ lbs).

4540
454
5994

4540
227
4767

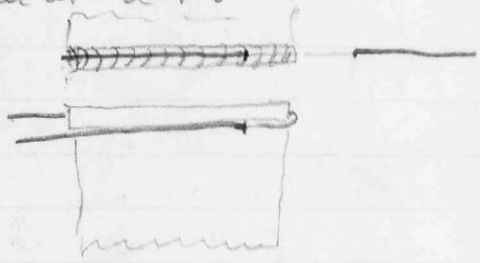
1892 Oct. 26 — Wed — at BB — Lab —

Preparing a gun-powder quill to start off rockets. Try one first.



Soldered at a & b.

Next. Wrap one half with soft paper
Then bend as shown



Now continue the wrapping.

And shove whole thing into quill — paper plugging one end.

And fill up rest & rest of Quill with gunpowder

Exp. 1. Quill has now been made and one wire fully wrapped other partially as shown

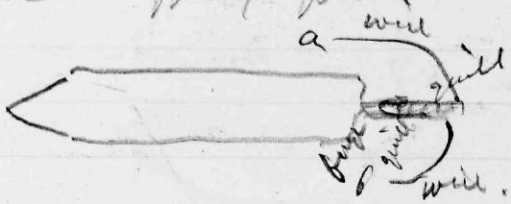
Wires a & b connected to dynamo by two wires each about 75 feet long

O.K. Gunpowder has exploded O.K. and wire is O.K.

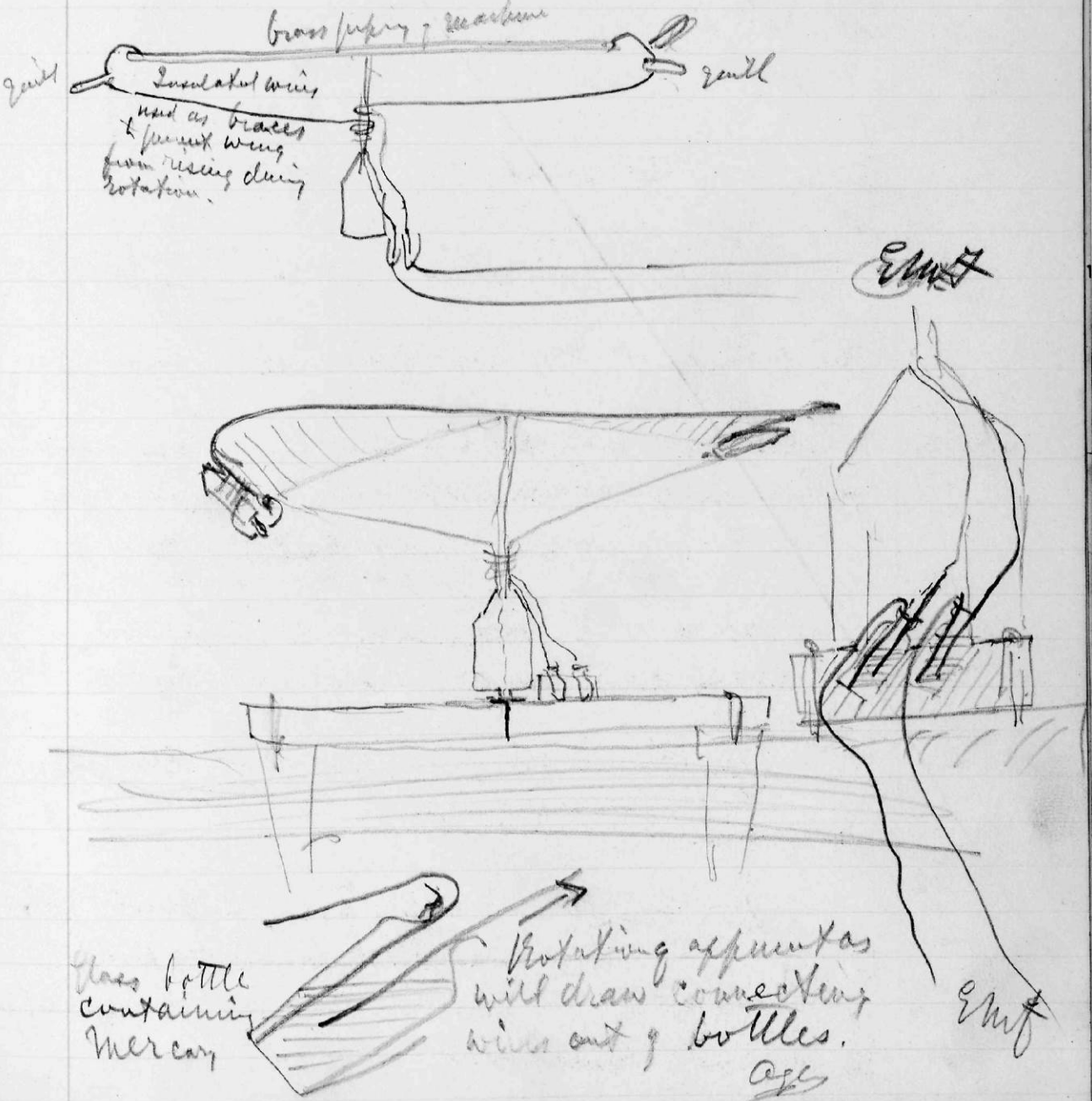
We propose to use two gun powder quills to set off two rockets simultaneously — one attached to each wing — and shooting in opposite directions.

1892 Oct. 26 — Wed — at KK Lab.

Propose to untwist fuse of rocket and insert in fuse nozzle of quill. — When dynamo is connected gunpowder will blow right into rocket — & set it off.

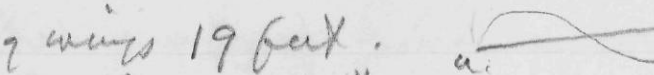


Connections as follows

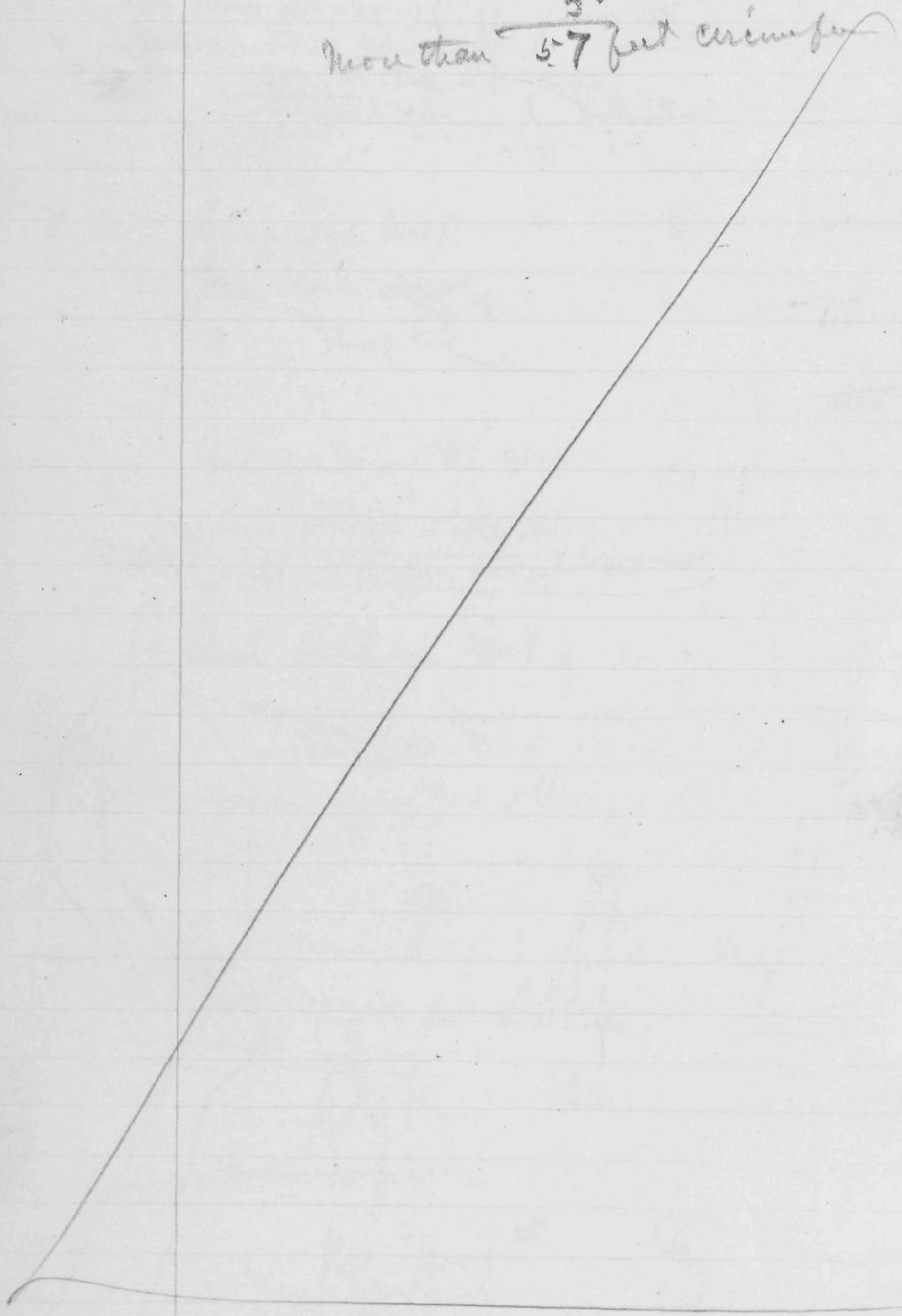


1892 Oct 26 — Wed — at MB. Lab.

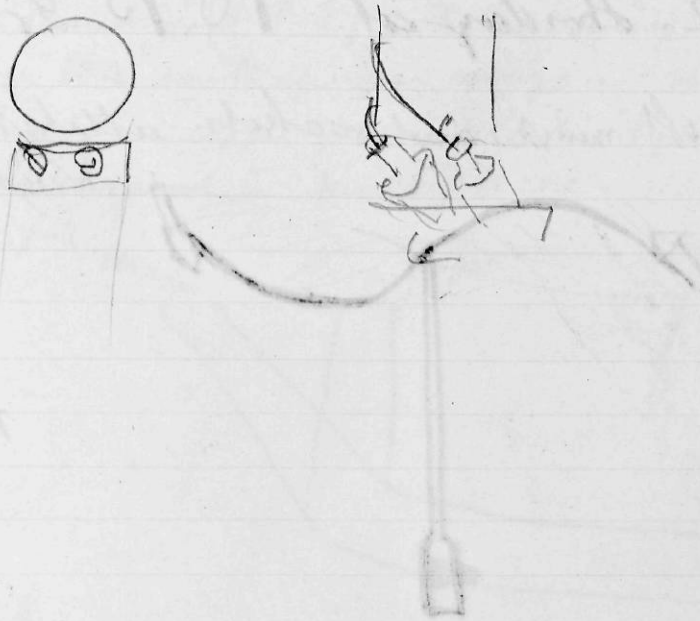
Spread 9 wings 19 feet.
Britain a b = 19 feet.



More than 5 3/4 feet circumfer



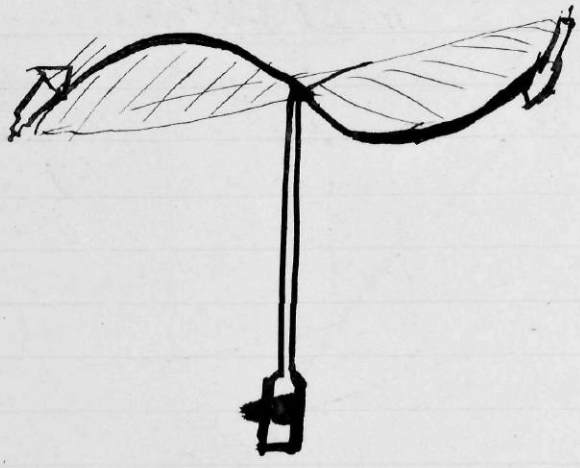
1892 Oct. 27 — Thurs. — at U.S. Lab.



1892 Sunday at B. B. Lake

Exh 1

With 6ft wings, and rockets attatched

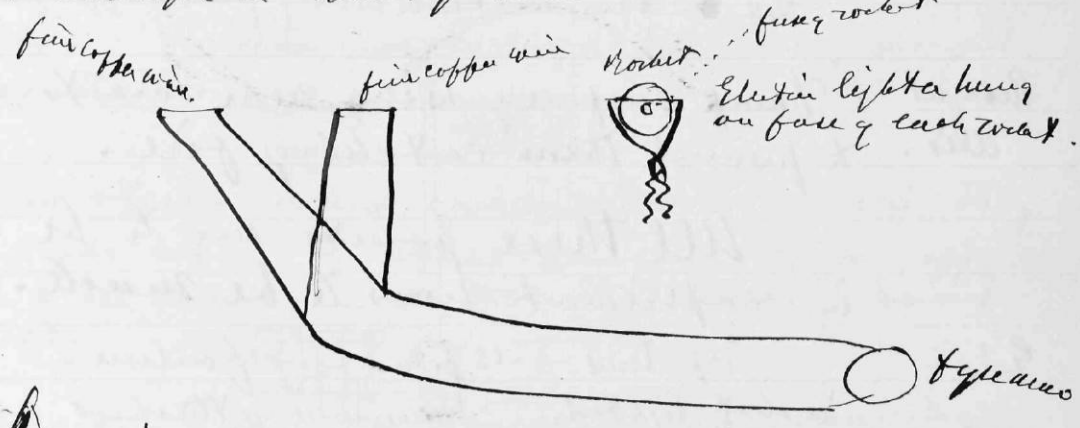


Weight

1386
50
20
10
10
1476 grams

1892 Nov. 1 — Tuesday — at B.B. Lab.

Last Thursday (Oct. 27) tried wing-piece shown on page 184 with paper wings — diam. 6 feet — . Used fine copper wire for electric lighter — two pieces arranged in multiple arc.



When experiment was tried only one rocket was set off — other for some reason hung fire — so that copper was a failure. Paper wing was destroyed by fire — almost at once — by rocket attached to it. Alice then W. Ellis has re-covered framework of wings with black cambric as shown on p. 184. Total weight of apparatus 1476 grammes — including 7 electrical lighters. Experiment will soon be tried.

Weight Ellis.

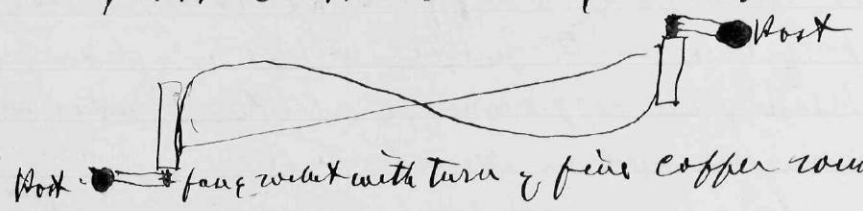
Fine copper wire a twist round fuse of rocket — fuse will burn quite away and release wire — if dynamo current does not melt it. Look out & have it spiral so turns will not touch. Last Thursday, we tried this with single rockets sent up in ordinary way. Seemed to work well.

Weight Ellis.

Plan two sticks vertically in ground under wing to support weight of wire attached to Electric lighters.

1892 Nov. 1 — Tuesday — at B.B. Lab.

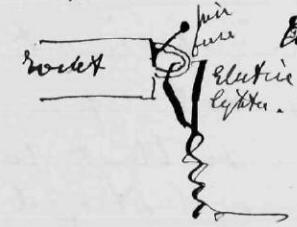
Thought Ellis. Place posts outside study wires.



Thought Ellis. Damp surface of wire near rockets with water to prevent them catching fire.

All these points are to be incorporated in experiment how to be made.

Ex Exp. tried 5.15 p.m. — failure — only one rocket lighted. Fuses were attached by bending round wire. Round fastened by a pin. Wire near fuse.



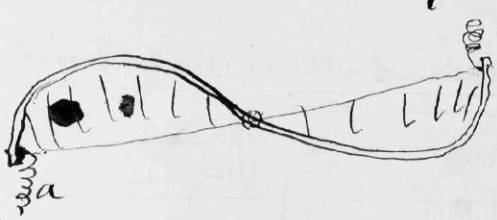
Wires rockets not separate

If one of the rockets starts (say that attached to A) the wire A will certainly be broken even if it is not melted by dynamo current — and then B will receive the full current of dynamo.

Trouble with last experiment was I think that — the same explosion that broke A caused rotation of apparatus that carried away rocket from B — before B had time to become red-hot. The shock dragged the rocket away from B. Now if B rotated with the rocket this could not happen. Try modification of old arrangement tried.

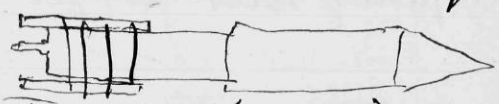
Thought — ag Try mercury cup arrangement with this apparatus & multiple arc connection — as follows —

Exp. 182

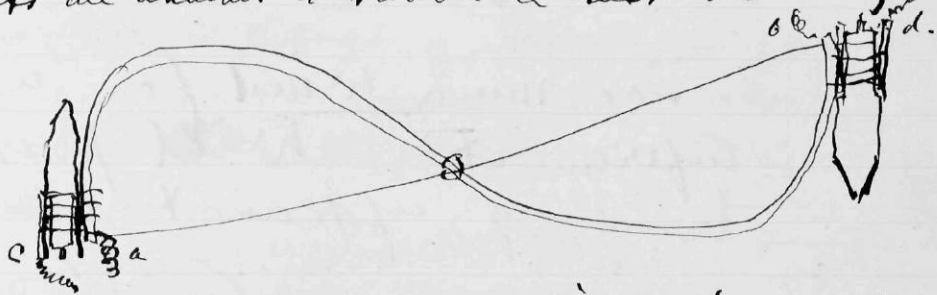


Solder copper wire at either end to metal pipe forming framework of wing as shown at a & b. Now attach rockets. The rockets used have two winged sticks attached.

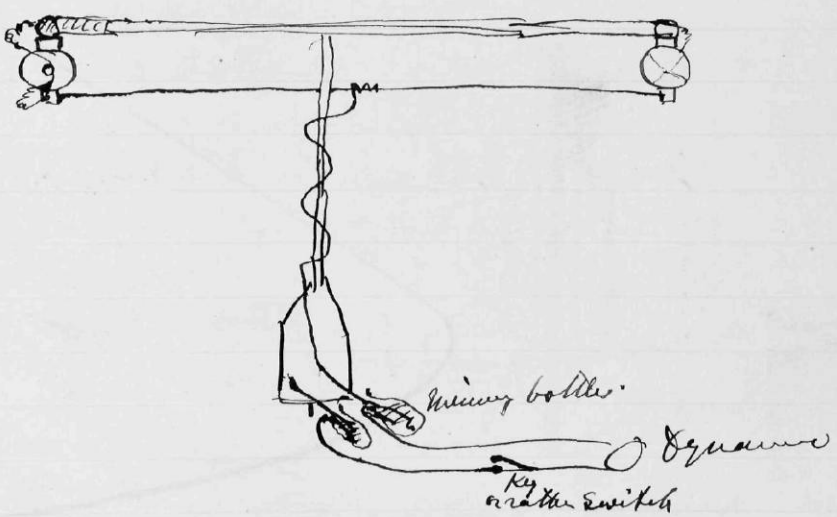
or rather feathered sticks which cause rotation when they ascend into air. The sticks have been sawn off close to the rockets — so that two pieces of wood are left.



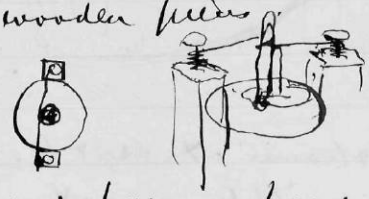
Rockets are attached as shown in next drawing



Piece of wire attached to ends of wooden pieces cd as shown & connected together by insulated wire running directly from c to d



Use Point Solder from wire at all — Cut Twist end round Tacks in ends of wooden pillars

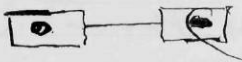


Make any connections desired to Tacks — and hammer home Tacks.

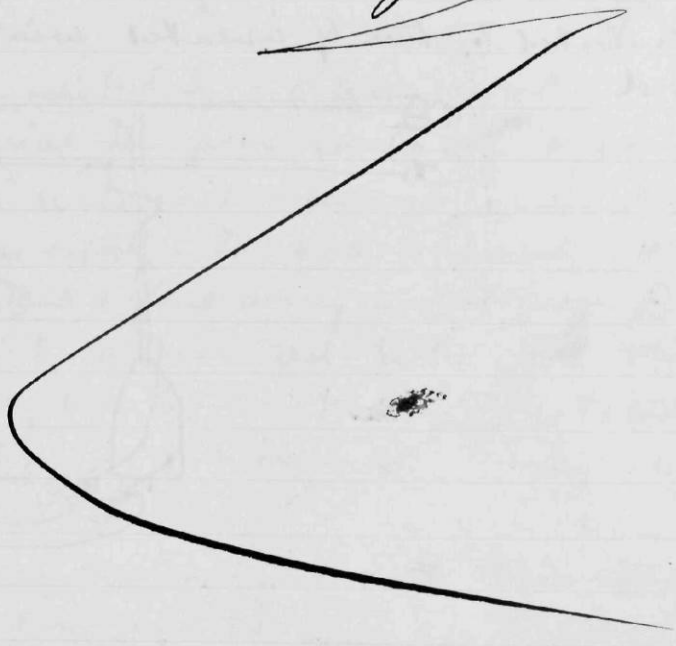
— Use metal washers under Tacks.

Use small sheet of tin with hole in it for Tacks.

Use small piece of sheet copper — instead of tin.



Too much wind for a good experiment — Will postpone trial of apparatus —.



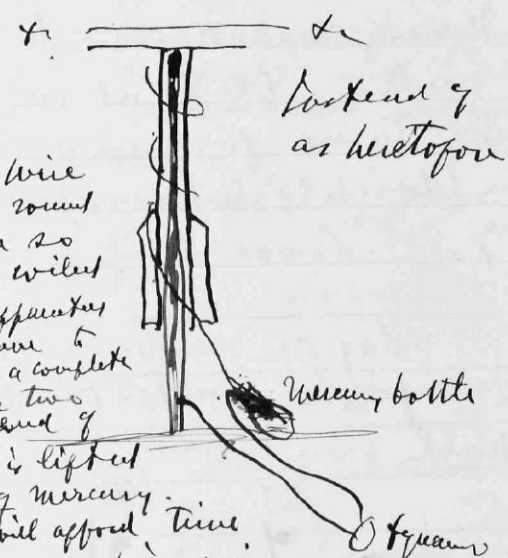
1892 Nov. 2 — Wed — at [redacted] Lab.

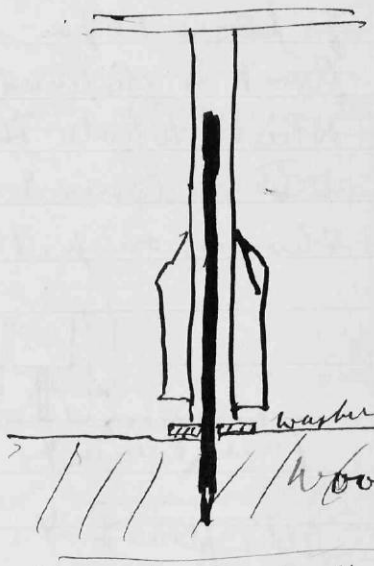
Exp. 1 Machine shown on p. 187 tried at 3.15 p. m. Result — a failure — only one robot started. Force was so great as to bend a 3/8 inch steel rod on which the whole thing turns — so that it cannot be used in another experiment. Examination shows that the fine wire attached to other robot was broken — it was either broken ~~originally~~ before the experiment — although we examined both connections and they seemed O.K. or was broken at the moment of starting. Whole thing looks promising — will try once more.

Nov 4th 92 Make circular trough of mercury — for one connection — and connect other wire to rod on which the whole thing turns.

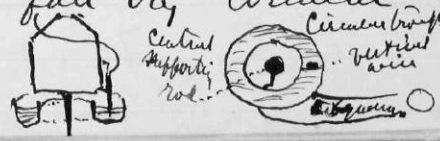
~~Take~~

Nov 4th 92 Make central rod sufficiently long to support weight upon its upper end





After first robot has started — if showed this fail try circular

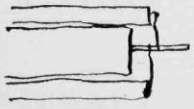


1892 Nov 2 — Wed — at BH Lab

Nov 2 Think I see why fine wire broke. Fuse & rocket was to one side

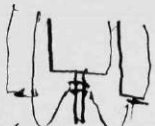
Jerk of first rocket would then cause air to act on fuse as a lever tending to break fine wire connection. As wire is finer than a hair — and initial jerk was very great this probably was the reason why last paper. was a failure.

Examination shows that W. Ellis. has arranged apparatus for next experiment in same way. He is now disconnecting fine wires and re-arranging them so that fuse is not to one side but so



Exp. 2. One connection made with rod on which whole thing turns — other with Mercury cup. (Multiple arc connection) — See bottom of page 187 — Mercury cup attached to metal float is dispensed with. Vertical rod on which whole thing turns forms one connection — other connection (double coiled wound pipe) as shown on p. 187. Loose coil.

Nov 11 and 2

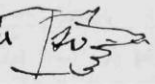


Lag on either side of fuse — so that rotation of fuse cannot pull fine wire

Nov 11 Ellis

Ellis' plan best.

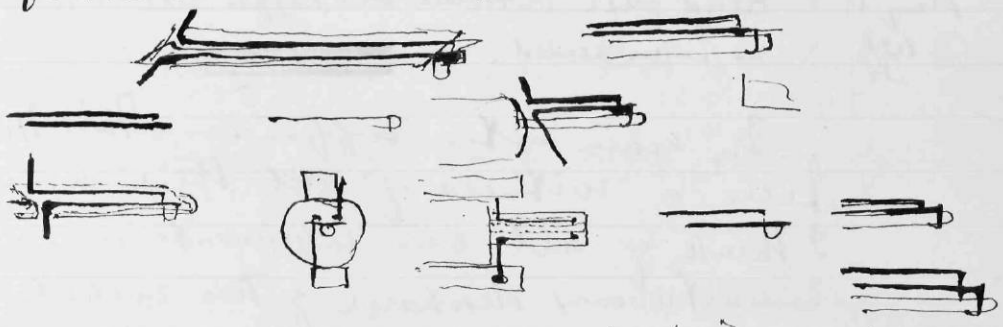
Fuse rests on U shaped fine wire. Thus the other fuse rests on turn of wire



Exp. 2 (Rocket) Failure — only one rocket went off — wire attached to other fuse broken.

The ⊔ shaped wire worked O.K. the ⊓ wire broke and did not ignite its rocket.

N.B. By the bye — this rocket — though it looks O.K. is the same one that has failed us all the time. Will therefore lay it aside — and use two fresh rockets altogether.



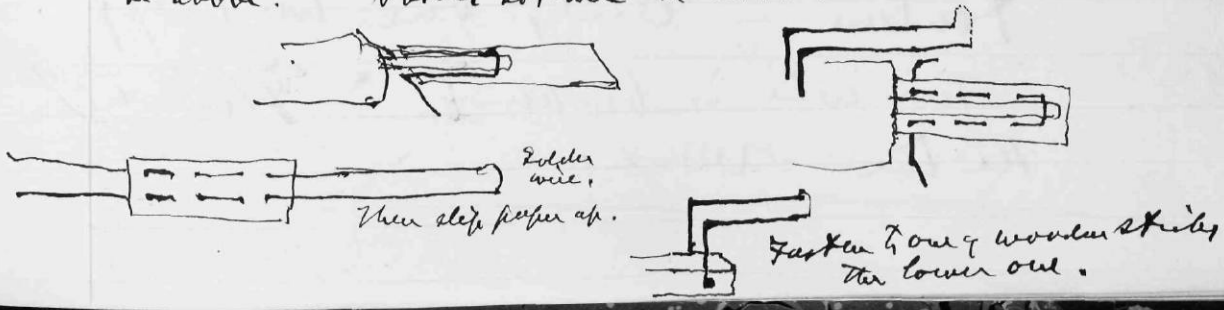
Rocket Exp. 2

Rocket Exp. 2 Paper vane below — fuse and fine wire bridge above. Weight of paper & connection wires will cause whole things to sag down.

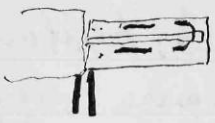
Now if our rocket starts first then when jerk comes on other — the air acting on vane will lift other fuse into horizontal position without any strain on the fine wire & bridge.

Rocket Exp. 2 No harm in making paper vane longer than fuse.

In order to avoid strain should fuse & fine wire be below — or above paper. Evidently thick conducting wires should be above. Should not all be above.



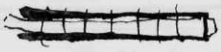
1892 Nov. 2 — Wed — at WS Lab.

Exp. 3. Rockets armed with paper vanes 

Failure — only one rocket went off.
Fine wire bridge of other rocket broke.

Mem. Trouble is that wire & paper vane vibrated & fuse being free struck against fine wire & broke it.

Nov 1 92 Tie fuse to paper with thread.

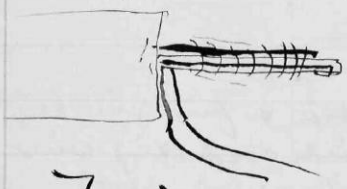
Nov 1 92 Bind fuse between two copper wires with thread — no paper needed. 

Try again after supper. Mr. Newton has been a witness of all these experiments and, I think of all our experiments involving the simultaneous discharge of two rockets.

Nov 2 92 If when discharge of one rocket takes place, — the two wires should come into contact they will short-circuit the other electric lighter.

Nov 2 92 Ellis. Arrange the two wires so that when thread is burned away — they will spring apart — Let them have a spring to them.

Exp. 4. W. Ellis is binding each fuse between copper wires as shown above — no paper used.



Trial.

Failure — only one went off.
Fine wire is broken. Mem! See the reason —

E. O. The wire from one wing-end to the other, of course, is jerked by the pressure.
Now it is attached to wire of the fuse by only one tack —  so that jerk causes a partial rotation of wire on tack as centre — & strains the fine wire.

Thy H Ge Remedy Two tacks — 

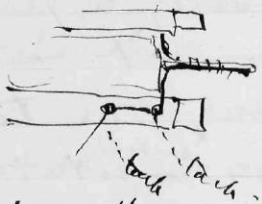
Very likely — this is the whole trouble

Try two tacks for each wire —

1892 Nov. 3 — Thurs — at O.K. Lab.

Exp. I

Machine arranged again with  connection and two tanks to each wire instead of one.

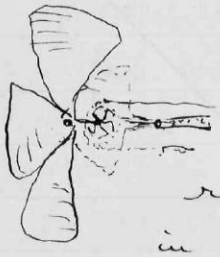


Failure — neither rocket went off. Trouble is evidently short-circuiting through moist snow. Ground covered with snow which is now in a slush. Will postpone further trial for better weather or more suitable weather. Present:— Mr. Blanchard, Mr. Ellis, & I.

C.A.G.

P.S. Find that the dynamo is not working — no current produced by rotation — wire broken somewhere

Thought Blanchard.



To preserve the impact and to present to the steam jet a more resisting surface than air, place in a tube (into which the steam nozzle leads) a small fan to be driven by the steam jet — On the fan spindle at its extremity place a larger fan which rotating drives the vehicle —

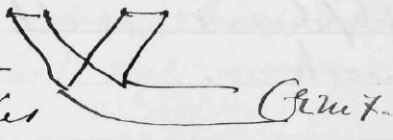
N.B. Kept

Examination shows that the terminal of one of the coils is broken close to the coil itself. Mr. Ellis will repair the dynamo and if O.K. will repeat experiment I.

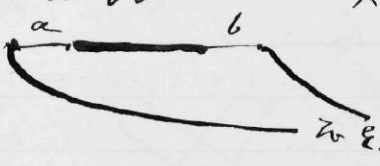
Exp. 2.

Failure — one rocket went about — one wire of the other broken.

Exp. 3. We have hitherto tried the electric lighters in multiple arc



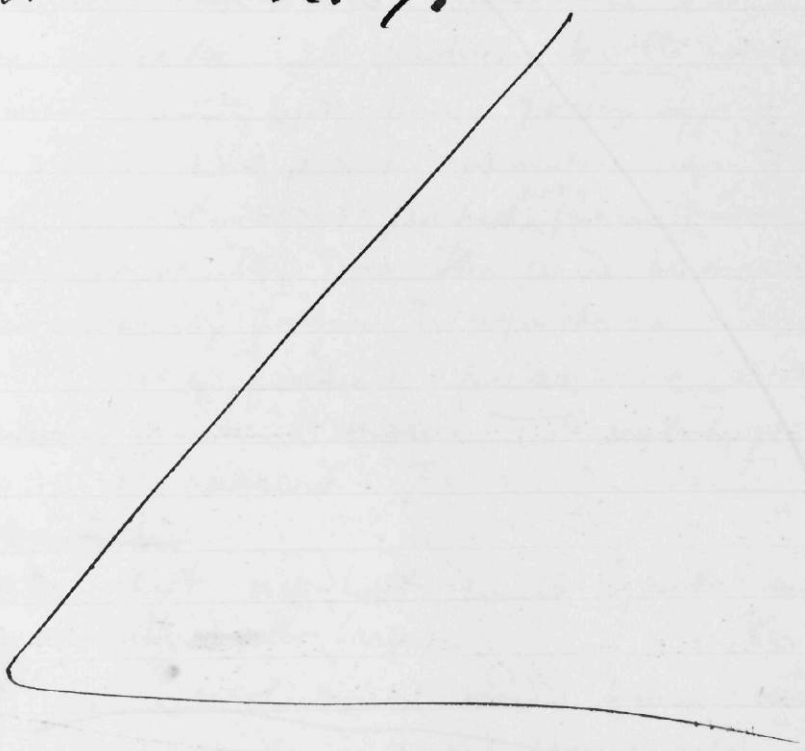
We tried german-silver wire in series with poor results — but we have not tried thin fine copper wire lighters in series. Will now try to ignite two mercury globules simultaneously by two fine copper wires a+b, connected in series



Result: — No — only one goes off — wire breaks before the other has become red-hot.

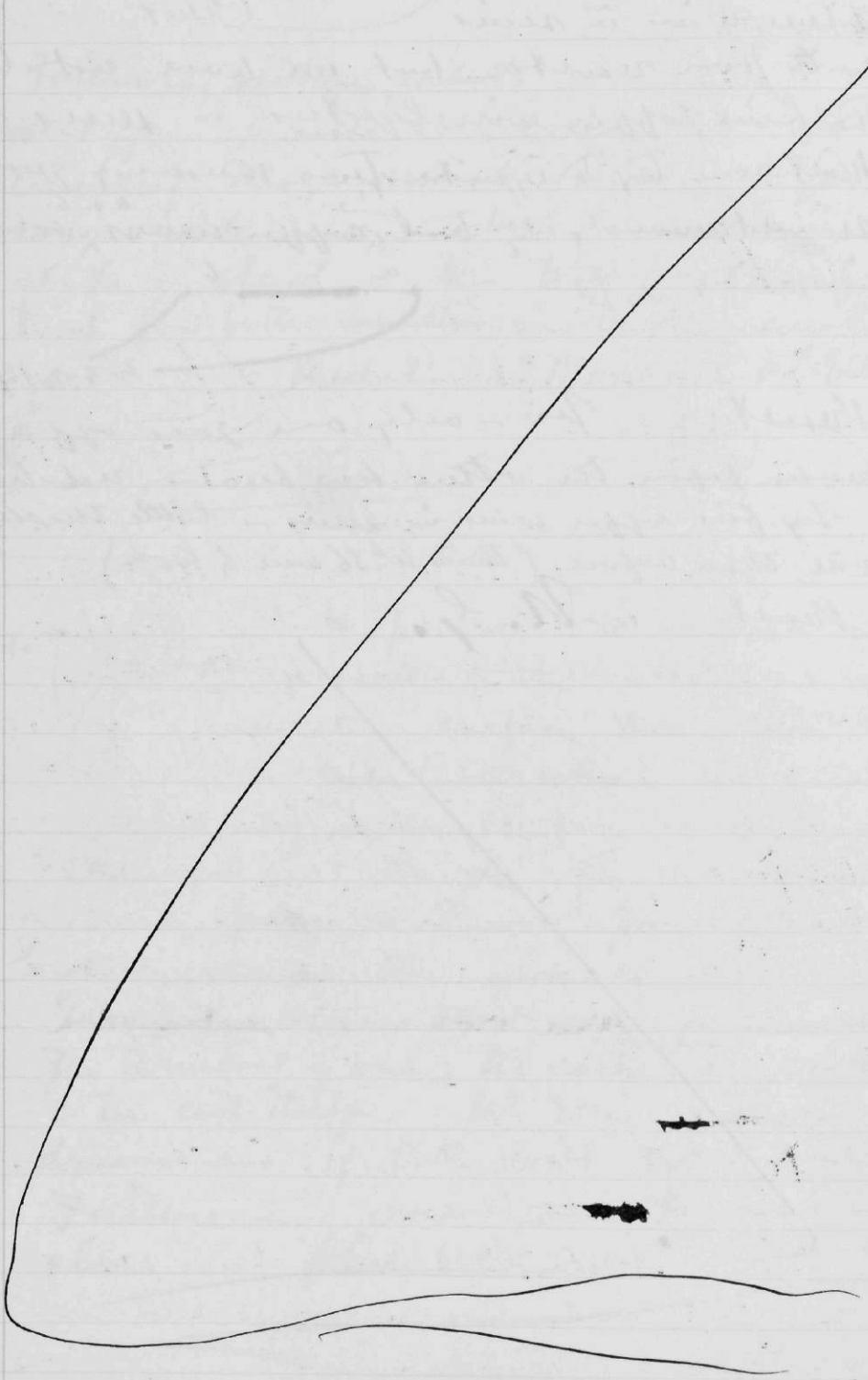
Exp. 4. Try fine copper wires in series — little thicker wire than before (Brit. No. 36 wire by book) —

Result. N. G.



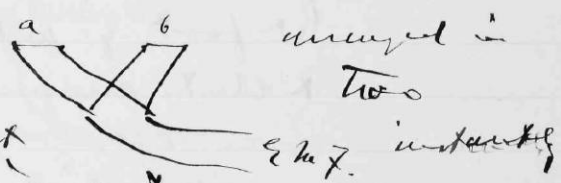
1892 Nov 4th Friday at B B.

Expt. Multiple arc, with .004" copper wire, would not work



1892 Nov 5th Saturday at B. B. Lab

Expt 1 Multiple arc one side .002" wire (copper) the other .0045"
Result- Both became red hot, but not quickly.
Expt #2 Like #1.
Result- N. G.
Expt #3. With both sides of .002 wire
Result- Both went instantaneously.
Expt 4th With wire to experimental ground, small wire .002
Result- O. K.

Two fine wires a b, 

arranged in multiple arc — inflame mixture of gunpowder about — both wires a & b burning out. Two Exp 7. instantly

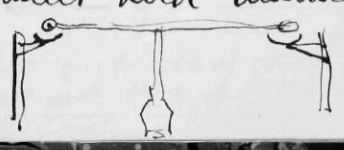
Thought Perhaps in our experiments with rockets with fine wires in multiple arc — the broken connection of the wires indicates that the electrical action was complete — perhaps both wires had burned off — but one, going off a little before the other, had jerked apparatus so that fuse of 2d rocket was jerked away from fine wire — just at the time the wire became hot — thus causing failure to ignite.

Cause of failure fuse and not electrical wire — Wire broken — not by jerk, but burned by current.?

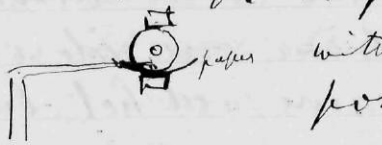
~~Expt~~ ~~Not Good~~

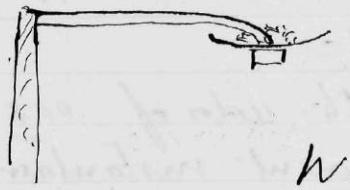
Thought. ~~By~~ Let red-hot wires ignite mixture of gunpowder and magnesium ~~wire~~ fuses.

Thought Disconnect electrical wires from wing pieces and flash powder in paper saucers held near the fuses & attached to wooden posts.

Will try this plan. 

1892 Nov. 5 — Sat — at Bbs Park.

Exp. 5 Find that Mr. Ellis has arranged the paper squares on the rockets —  with electric lighters attached to posts —

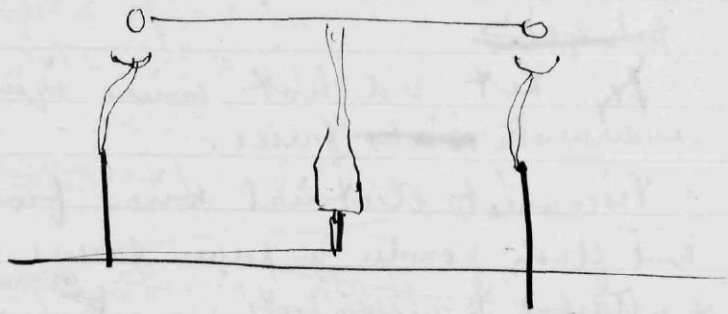


No Electric current by thermolars. connecting rockets. Will try this arrangement first — and then if one rocket fails to light — will try arrangement suggested at foot of p. 197 — with gun-powder squares & elect. arrangements — entirely independent of rockets so as not to be moved when rockets move.

Elect. lighters arranged in multiple arc.

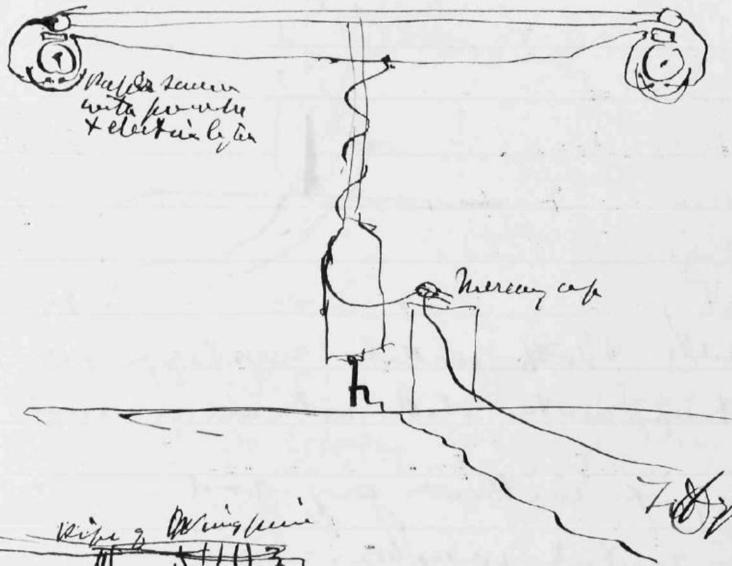
Result:— O.K. at last. Both rockets lit simultaneously — vertical rod swayed — and rotating wing piece — struck against vertical wooden rods — dragging them out of ground and throwing them to a distance of 10 or 15 feet — smashing one — connecting wires were also caught and twisted up — & broken in places. Had it not been for these obstructions — we think the machine would have risen.

Try.

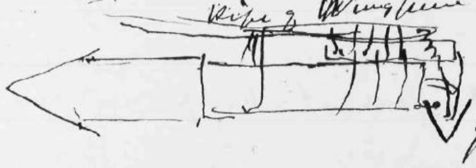


Nugent exp.

Better still — adopt old arrangement and let machine carry wire with it. Connection by mercury cup below. Have used up the double stick rockets & now have signal-rockets with only one stick.



Exp. 6.



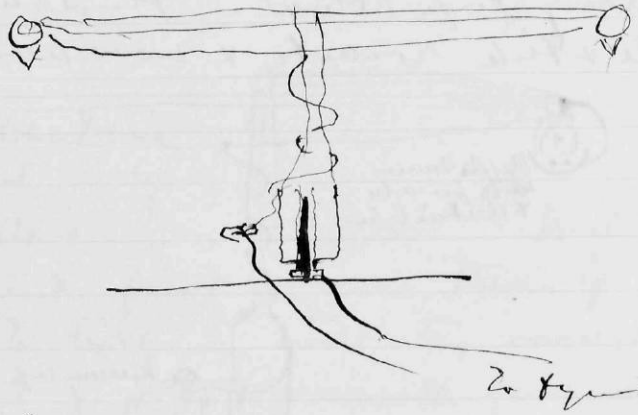
Paper cone pinned to rocket underneath fuse — contains gun-powder — electric lighter goes into gun-powder. Similar arrangement on other rocket. Multiple arc arrangement ~~of~~ of circuit as shown above. Mercury ~~cup~~ bottle completes connection.

Nugent Ellis. Mr. Ellis is afraid that length of supporting rod may prevent apparatus from clearing itself. Central rod three feet long. If it does not clear itself — will cut the rod down to 6 inches allowing it to turn on metal washer below. Will try it in present condition first — as shown ~~below~~ above.

Result: O.K. Both rockets went — and machine lifted about one foot but did not clear itself. Rod swayed and held it.

200 1892 Nov. 5 — Fort — at Ball Rock.

Exp. 7 Apparatus tried again with steel rod only 6 inches long



Result Both rockets went off simultaneously, but apparatus did not clear rod.

Result Try it without any rod — simply standing on metal washer.

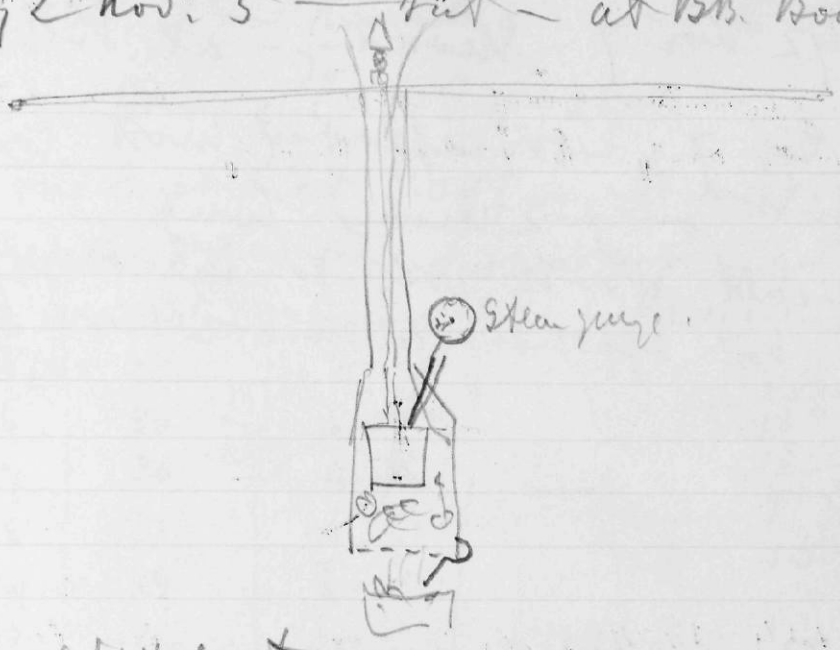
Result Ellis. Won't stand — but give it help on inch of rod & stand on.

Columbus Entertainment at Warehouse this evening.

Exp. 8 W. Ellis has fitted old boiler to 12 foot rotating pipe 1/4 inch diam. 0.05 nozzles — with a vertical pipe 6 ft long 1/2 inch dia with vertical chimney 6ft long diam. varies from 1 3/4 inches to 2 inches. Steam gauge attached — Whole thing suspends from roof & boat-house —

Will now try rotation on steam pressure!

1892 Nov. 5 — Test — at Bk. Boat house



Fire lighted at 10.53 p.m. Steam shows 11.00 p.m.
11.05 starts revolving 8 lbs pressure

Time	rot.	press.
11.06	26	17 lbs.
11.07	30	17 lbs.
11.08	32	17 lbs.
11.09	33	17 lbs.
11.10	33	17 lbs.
11.11	30	17 lbs.
11.12	28	15 lbs.
11.13	26	13 lbs.

Fire put out.

Revolutions.

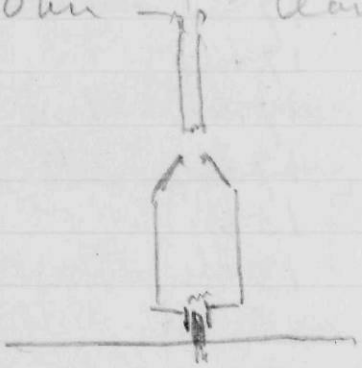
$$\begin{array}{r} 12_3 \\ \hline 36 \\ 33 \\ \hline 108 \\ 108 \\ \hline 6.0 \;\big|\; 118.8 \text{ ft lbs per min.} \\ \hline 19.8 \text{ ft lbs per sec.} \end{array}$$

1892 Nov. 7 – Monday – at MBL Lab.

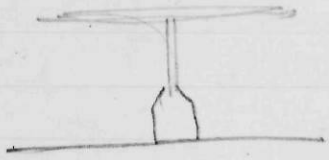
Exp. 1. Exp. 7 (p. 200) repeated with central rod only 2 inches long.

Result: Both rockets went off together – but apparatus rocked while rotating.

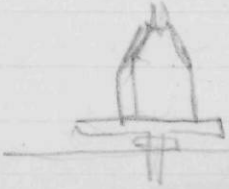
Rod seems to hold it. It seemed to be struggling to rise but could not. At last it broke the brass rod near top of central rod – broke soldering of rod to float – and rose about 1½ feet & then fell down – leaving float on central rod.



Exp. 2 Try standing on float alone without any central rod.



Exp. 3 Or let float stand on wooden disk which can turn too



1892 Nov. 7 — Monday. – at BR Lab.

Exp. 2. Repetition of Exp. 8 p. 200.

Fire lighted at 3.09 p.m. Steam about 3.21

Pressure-gauge does not show anything yet.

Time	rotation	Pressure	Remarks
3.25 p.m	26	3 lbs	
3.26	30	5 lbs.	
3.27	30	4 lbs.	
3.28	31	4 lbs.	
3.29	29	3 lbs.	
3.30	28	3	Tapped fire-box
3.31	28	4	
3.32	29	4	Shut down trap-door above house. but which lets cold air down
3.33	29	4	
3.34	27	3	
3.35	28	3	
3.36	28	3	Musical sound from something belongs to indicate friction on axis.
3.37	28	3	
3.38	24	2 1/2	Friction sound.
3.39	25	2	
3.40	25	1 1/2	
3.41	25	1 1/2	Tapped fire-box.
3.42	25	2	
3.43	25	2	
3.44	25	2	
3.45	24	2	
~~3.46~~		1/2	

36
25
18 0
73
60 | 91.0
15.16

36
30
6 | 108.0
18 ft

1892 Nov. 7. — Wrenden at W.B. Rothwell

Exp. 3. Fire lighted at 5.25 p.m. Blast started 5.35

Pressure = 16 oz. This is a repetition of Exp. 2 excepting that smaller nozzles are used — Nozzles = 0.035" inches diam.

Time	Rotation	Pressure
5.37 p.m.	29	6 lbs
5.38	33	15 lbs
5.39	36	15"
5.40	39	15"
5.41	39	15"
5.42	37	15"
5.43	36	15"
5.44	34	15"
5.45"	32	15"
5.46	32	15"
5.45"	32	14
5.46	29.	12

Fire put out.

Rotary

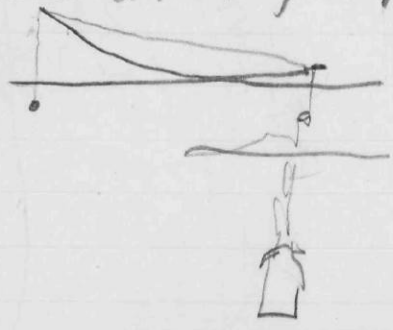
39
36 5"
234
117
6" | 140.4
23.4 ft per sec.

Work off

Fix blow-pipe under fire-box on floor — & blow up air by means of Root's blower & forge. What we want is better draft.

Weight off

Weigh whole arrangement while rotating by suspending it to one end & bent round.



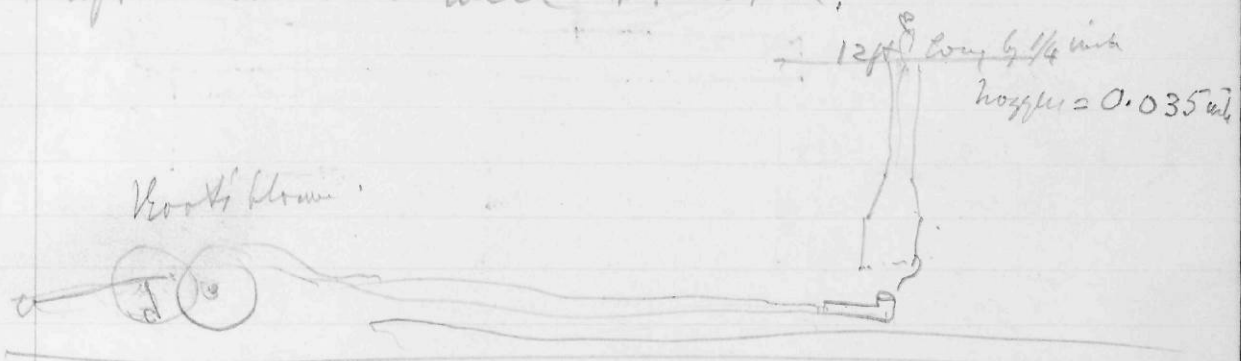
1892 Nov. 8 — Tuesday at 1845 Lat 6

Fire lighted at 5.20 Steam shows 5.34

Pressure - does not show yet.

Engine 1.

Same apparatus as that used yesterday in Engine 3 p. 204 — but we now have a Root's blower attached to an iron pipe 3/4 inch by means of rubber hose. This will be placed under fire-box so as to increase draught after rotation well started.



Time	Rotation	Pressure	Remarks
5.37	20	10 lbs.	Starts without blower.
5.38	25	12	
5.39	29	15	
5.40	32	18	
5.41	35	22	
5.42	36	23	Blower attached
5.43	37	30	
5.44	38	35 ?	35 ?
5.45	41	36 ?	40
5.46	45	40 ?	42 Straight arrow
5.47	49	45 ?	45
5.48	52	50	← next figure

36_{52}

7^2

180

$6 \overline{)1872}$ ft per min

31.2

1872×60

112320 ft per hour

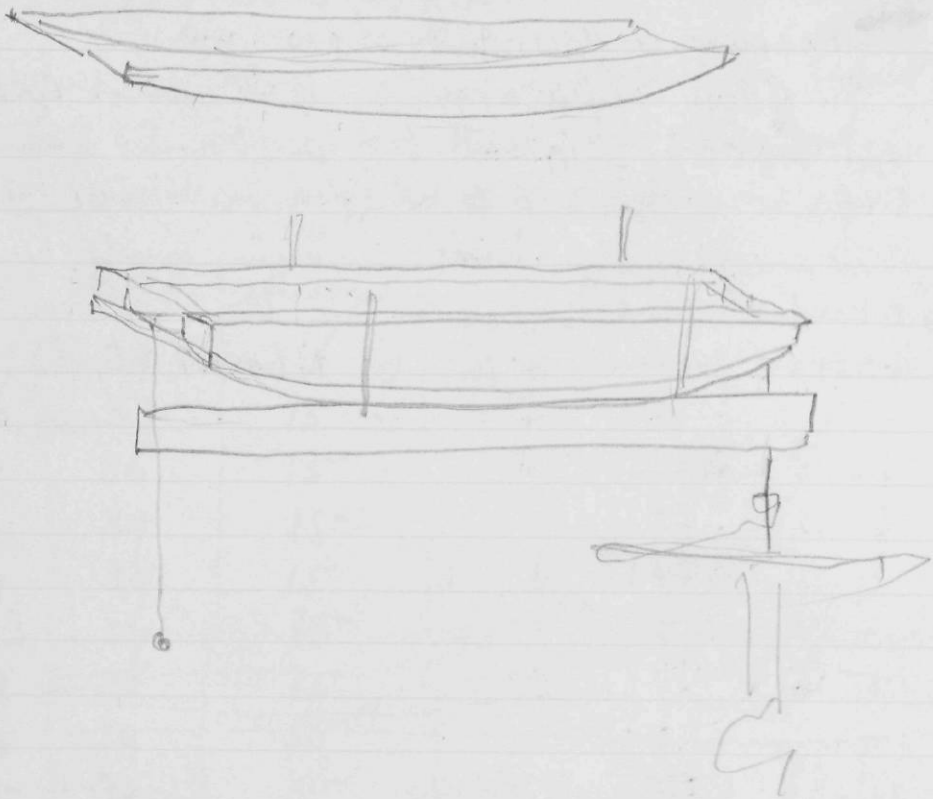
$5280 \overline{)112320} (21$ miles per hour

$105\,60$

6720

5280

440



1892 Nov. 9 — Wed — at KB. Lab.

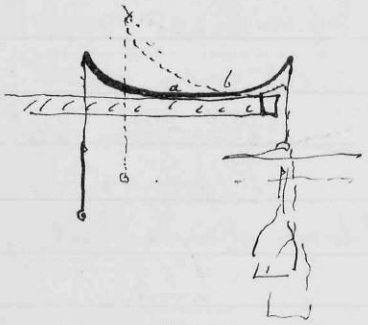
Fire lighted at 3.40 p.m. — Exp. on p. 205 repeated with Carpe roggles — Roggles = 0.05" index diam.

Exp. 1.

Steam shows at 4.06 — Temp. room 44°F. Blower started

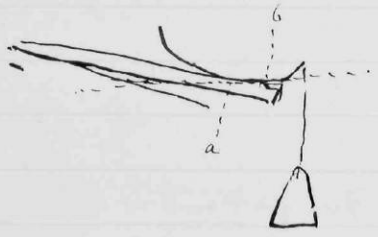
Time	Station	Pressure	Remarks
4.00	—	—	Blower started at 4 p.m.
4.10	19	5 lbs.	
4.11	20	5"	
4.12	18	5"	Burning
4.13	22	5"	
4.14	25	5"	
4.15	25	5"	
4.16	24	5"	
4.17	24	5"	
4.18	24	5"	
4.19	25	5"	
4.20	27	5"	
4.21	24	5"	Fire put out.

1892 Nov. 12 — Lect — — at 4½. Lab.



Spot (a or b) is always the lowest point of curve. Hence if apparatus carried a graduated ~~vacuum~~ glass tube — curved to correspond to shape of apparatus — or drop of mercury in tube could be used to indicate weight. ~~It would fly to rest at lowest part, take and indicate that point of support the real point of support~~

Apparatus is essentially a lever in which the fulcrum shifts. Drop of mercury should show true position of fulcrum even though support should happen not to be horizontal.

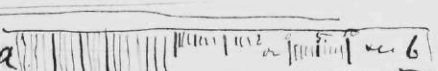


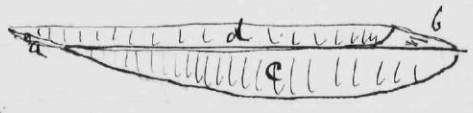
For example with sloping support point of actual contact might appear to be at (a) whereas real fulcrum is at (b) — Drop of mercury would indicate (b).

Good.

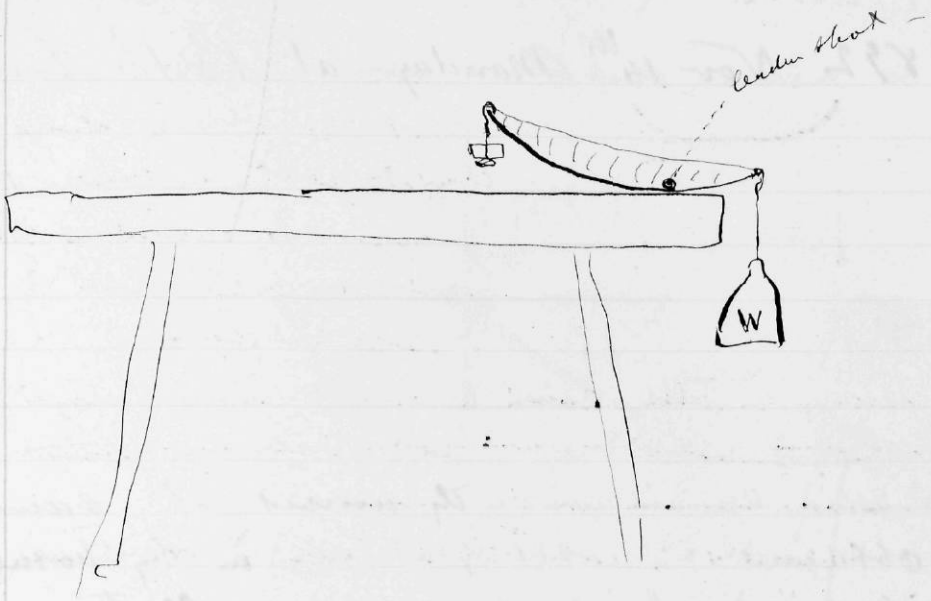
Could not simple weighing machine be made of a curved sheet of metal — (properly braced so as not to be bent out of shape by any weight to be tested) with a leaden sheet on it.

For example take sheet of tin (ab) and graduate it. Now solder it to two sides as shown.



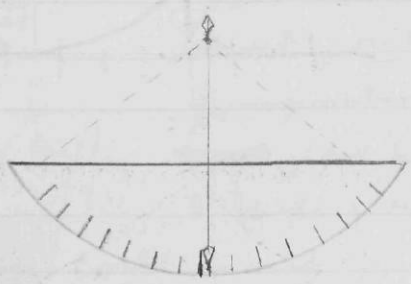


Place leaden sheet inside. Attach suspend weight from b and sheet should show position of fulcrum of Curve. If weight tips machine up too much — suspend a small counter poise from (a). Place apparatus upon a table or shelf with weight hanging over edge.


W

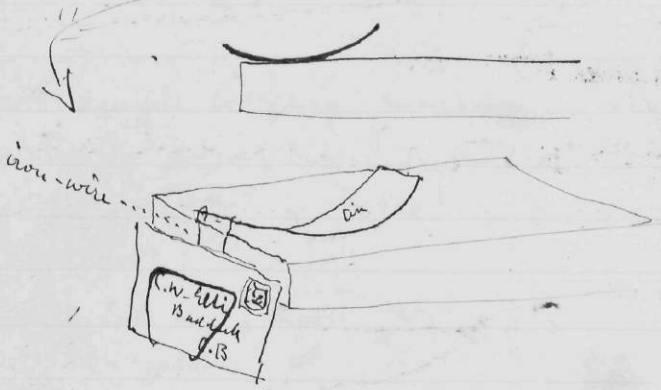
1892 Nov 14th Monday at B.B. Lab

Thought Ellis.



N.B. Mr. Ellis has independently arrived at same idea I obtained & noted yesterday in my home note-book - viz. Pointer suspended from centre of circle of which the machine is a segment.

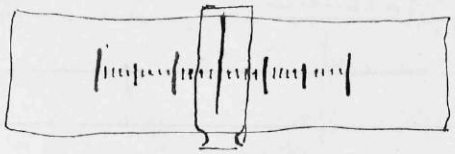
Yesterday I made a letter-weigher of tin which worked well

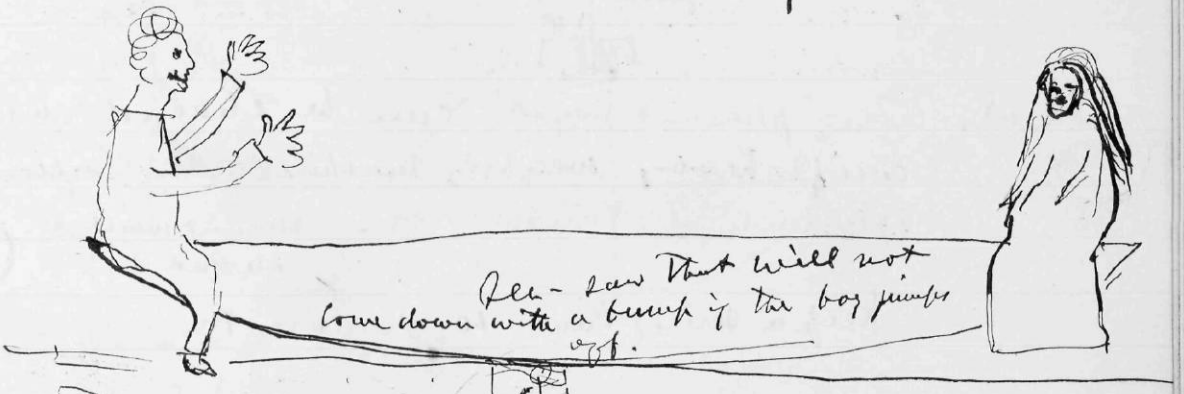


This was initialed A.G.B, A.A.B, M.G.B. Nov. 13th 1892 at B.B.

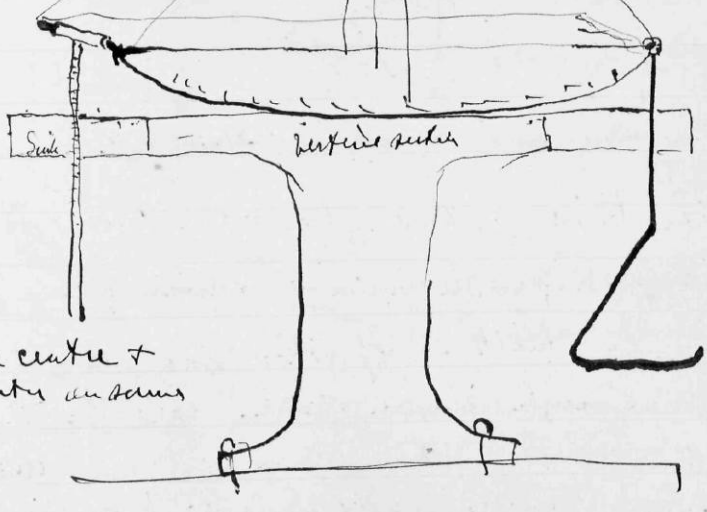
Also tried yesterday (Tuesday Nov. 13) a marker consisting of a sewing needle inside a small glass bottle - Seemed to work well - This was placed on convex surface of tin-weigher shown above. The bottle rolled down hill to lowest point & came to rest at lowest point of curve & the centre of gravity of bottle - If a scale had been engraved upon

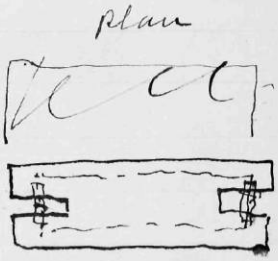
sunpan & tin — needle would have formed a fine marker.





Heavy boy at one end will balance light boy at other. Great advantage over ordinary see-saw.



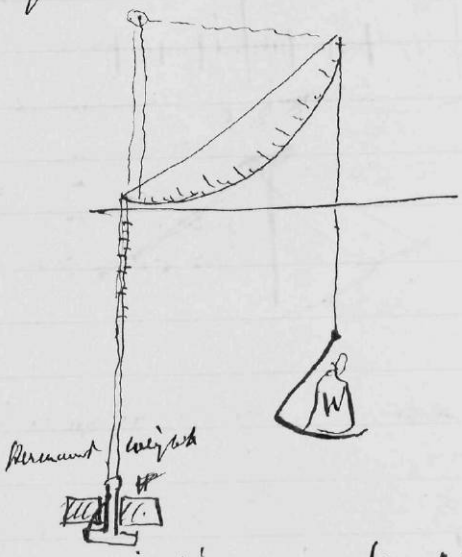


Impossible that
drawing - but
if you get the
idea - that's
what I wanted of.

also make centre &
hanging pointer on same
model.

212/892 Monday Nov 14th at B.B. Lab

Weights by 2nd permanently weight one end - 2nd set double the fractions. Make angle 90°.



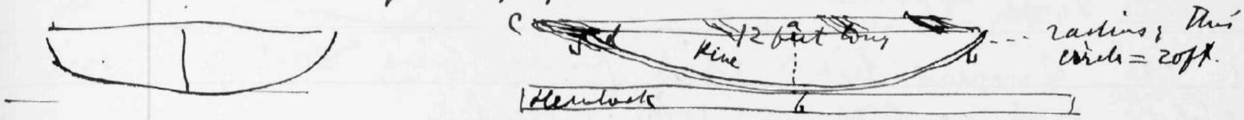
Weights. The "permanent weight" can be changed as in the case of many weighing machines — Scales — Howe's Standard — Fairbanks &c. Permanent weight Weight 20/3

Keep a series of them 10, 50, 100 &c —

1892 Nov. 22 — Tuesday — at B.B. Lab.

Mr. Ellis has finished 3 weighers.

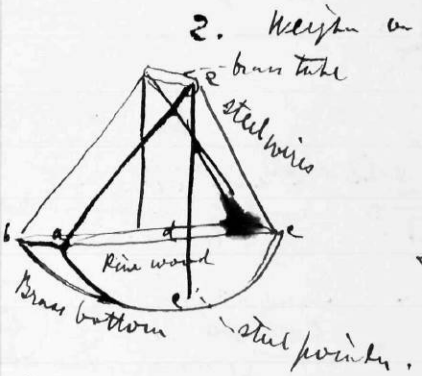
1. Original weighing machine (of wood for flying machine shown in rough on p. 206

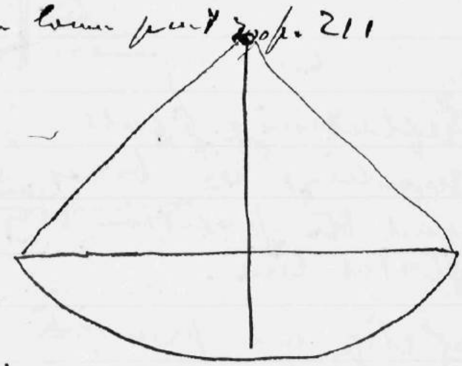


Height ab = 12 1/2 inches
Width cd = 7 inches.

Made of 1/2 inch pine.

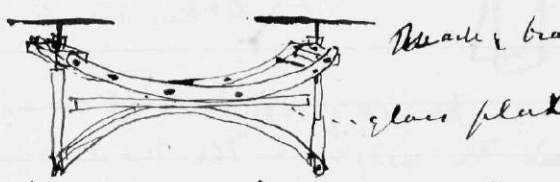
2. Weigher on lower part of p. 211





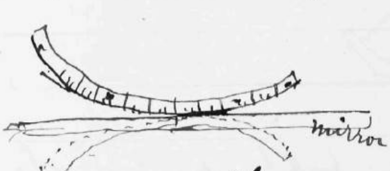
Length ac = 2 ft 8 3/4
Width ab = 3 inches
height cd = 6 1/2 inches
Radius ce = 2 ft.

3.



The treadle of pine prevents operation of apparatus.

Thought up



Will not reflection of scale in mirror enable us to read weight easily.

Exp.. Tried brass sledge rocker on plate-glass mirror.
Yes — O.K. but images separated by thickness of glass

Thought up — Try polished metal — bright nickel surface — or steel.

Wright
Ellis

Try a sheet of tin.

Exp.

Tried tin — O.K. Undoubtedly reflected scale appeals solution of points difficulty.

Wright
Cliff

Suspend light clip from one end of lever to hold letter or other object.

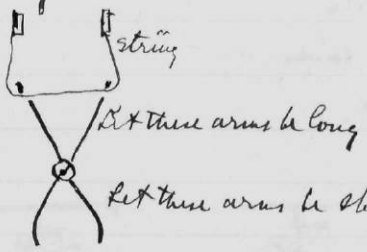
Wright
Cliff

Postpoint.

The reflection of scale good — have made fine markings on brass sledge rocker — & can read the position very accurately from co-incidence of reflected line.

Wright
Cliff

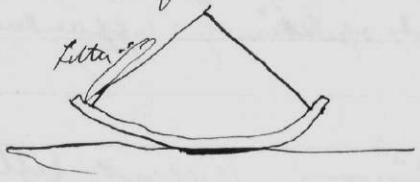
Try clip on principle of cotton-bale clip used in discharging cargo — the heavier the weights the more firmly it is held.



Wright
Cliff

Weight of object will cause itself to be gripped firmly. Heavier the weight — the more firm the grip.

Wright
Cliff

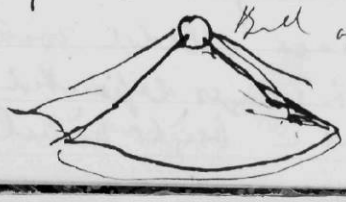


Wright
Ellis

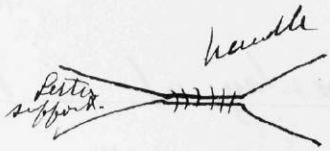
Four wires coming to a ball or handle to

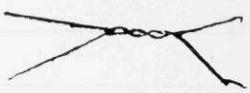
Light apparatus

Ball or acorn will balance however it rocks.

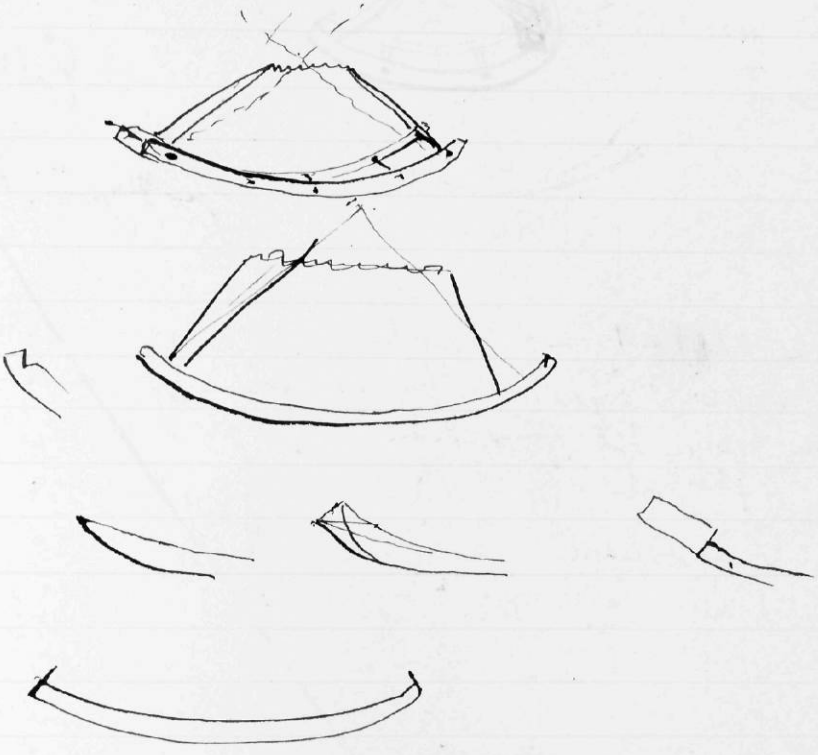


Ball or acorn or handle



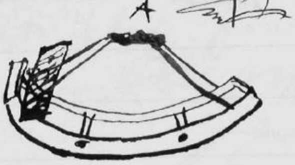


Twist two wires together

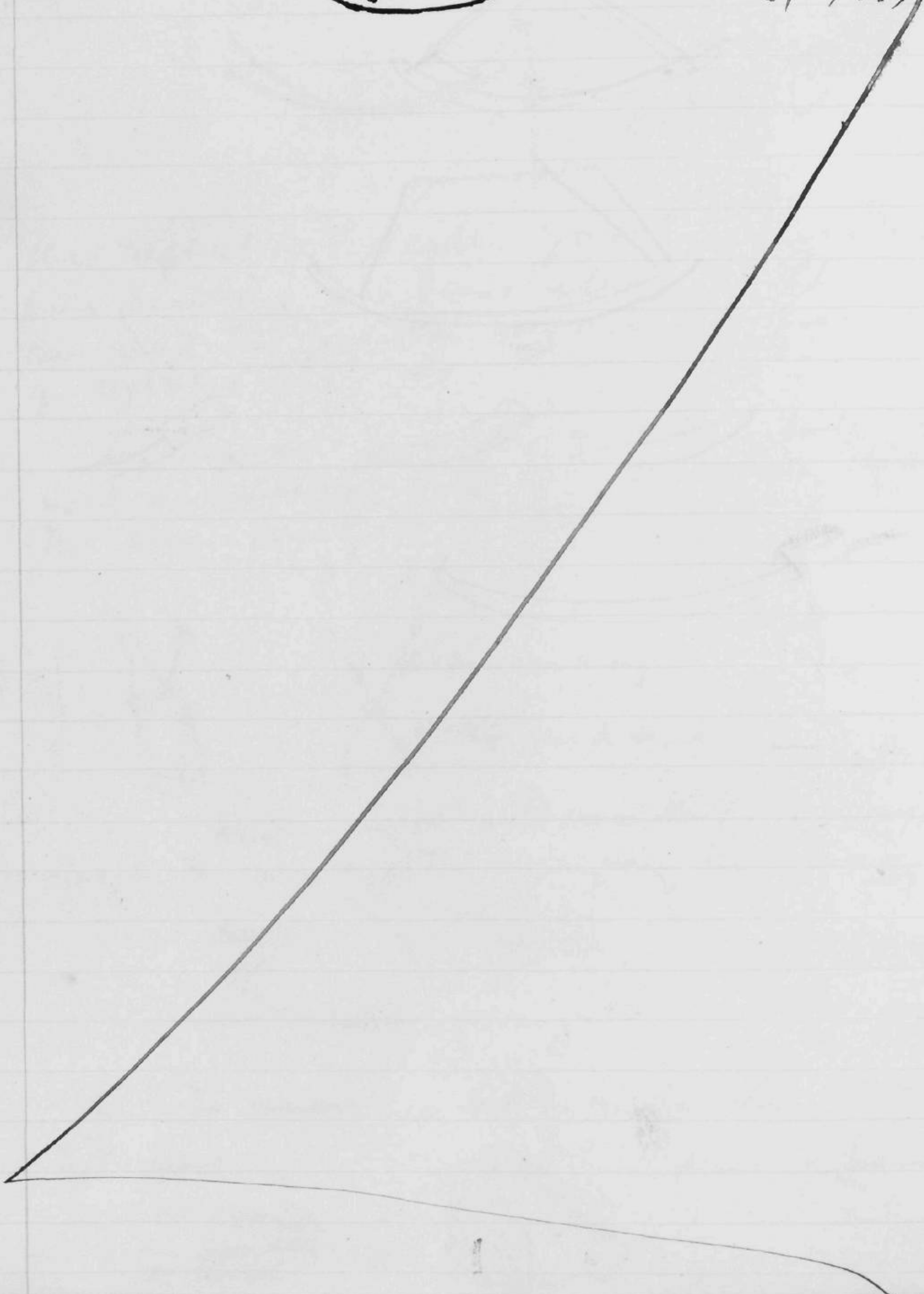


1892 Nov 23d Wednesday at B B Lab

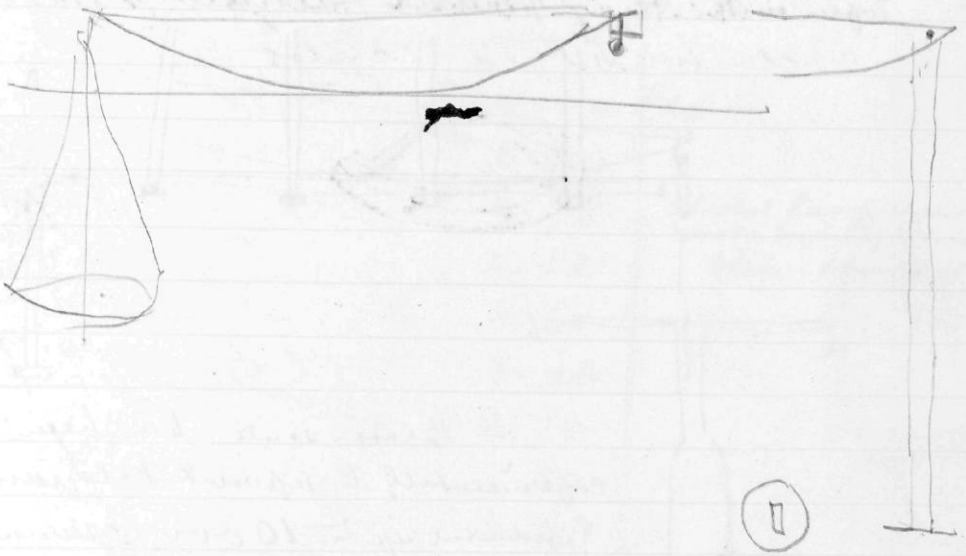
Addition to letter weigher, A made of brass wire twisted in centre.



G. W. H.

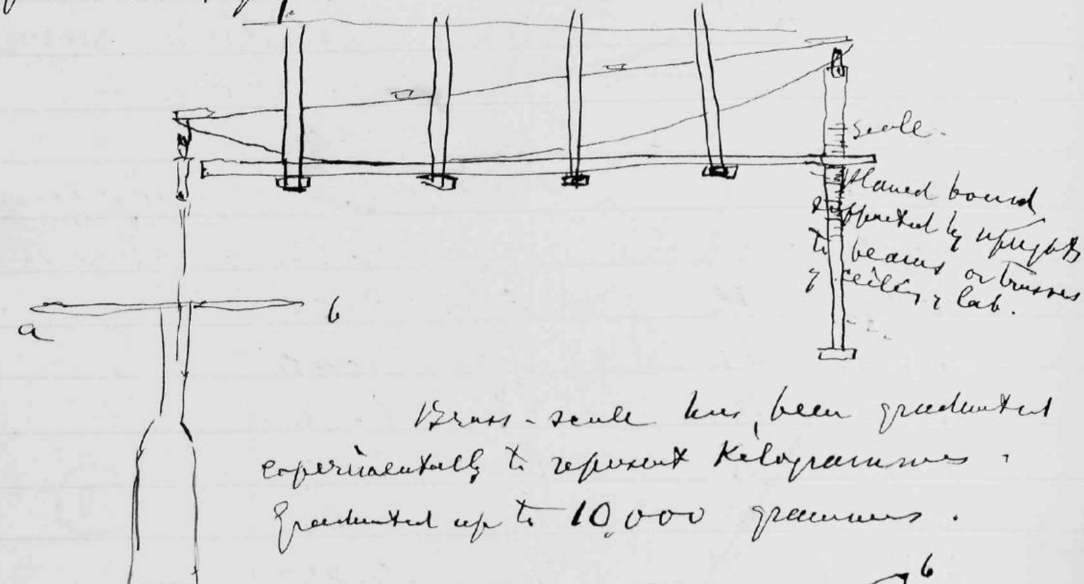


1892 Nov. 29 — Tuesday. at WBLab.



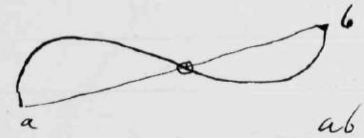
1892 Dec. 5th — Monday — at L.B.

Exp. 1. Original wooden weigher of page 206 has been ready for a long time — waiting for opportunity to try Exper. with Flying machine — Well

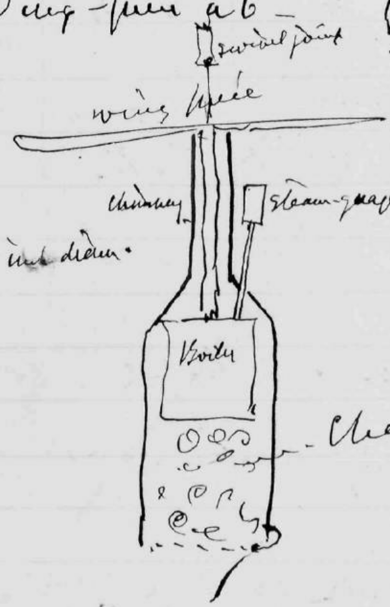


Brass-scale has been graduated experimentally to represent Kilogrammes. Graduated up to 10,000 grammes.

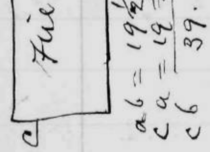
~~Rotating~~ Wing-pair ab —



ab = 6 feet.



Nozzle = 0.05 inch diam.



ab = 19½ inches
ca = 19½ inches
cb 39.

Angle of wings about 15° from horizontal

Boiler full of water.

~~Weigh~~ Weighs (Full) 9 Kilogrammes — Water, Fuel & all.

Nozzle let Ellis [illegible] — Mr. Ellis put about ½ teaspoonful of Turpentine upon charcoal to increase blaze — ~~[illegible]~~ light more quickly —

Fire started as usual by alcohol (5 wicked lamps) underneath,

1892 Dec. 5th Monday — at HS.

Fire lighted at 3.50 p.m. Steam blows at 4.05

Time	rotations	pressure	weight	
3.50	0	0	9.00	Kilos.
4.00	0	0	8.80	
4.04	0	0	8.75	Alcohol lamp removed. water begining to simmer.
4.06	starting.	0	8.52	Steam blows at 4.05.
4.08	13	5 lbs.	8.50	
4.09	14	5 lbs.	8.40	
4.10	16½	6½	8.30	
4.11	11	6	8.27	
4.12	10	6	8.25	
4.13	7½	7	8.25	
4.15	2	8	8.24	Stopped. goes on again slowly — Coal fire & good steam.
~~4.19~~	Something wrong Swivel joint		O.K.	

Mr. Ellis thinks we had too much water.

Weighing machine as steady as a clock.

Will make another fire and use boiler with with water now in it.

Examination shows that swivel has dirt in it — been exposed to smoke from chimney in this and other experiments & is quite ~~stiff with~~ difficult to turn with any weight on it. Will refill the fire-box with Charcoal — leaving boiler as it is

 1892 Dec. 5 — Monday — at G.B.

Exp. 2. Apparatus ready for trial again. No turpentine this time.
Fire lighted at 4.41 p.m. weight 8.26 kilo.

Time	rotat.	pressure	weight	
4.41	—	—	8.26 kilo.	
4.45	—	—	8.25	
4.54	—	—	8.15	Steam shows —
4.56	—	5 lbs.	8.00	~~Red~~ hot fire-box — ~~Starting in rotation~~
4.58	—	8 lbs.	7.78	no rotation
4.59	—	9 lbs.	7.77	no rotation
5.00	—	9 lbs	7.75	no rotation
~~5.01~~				Good fire — good steam good pressure & no rotation.
5.02	—	10 lbs	7.53	Started in rotation by hand. Came back to rest.
~~5.~~				
5.04	—	11 lbs.	7.50	

No rotation with good fire — good steam — and good pressure. Swivel joint must be looked at again.

Can hardly turn swivel joint by hand.

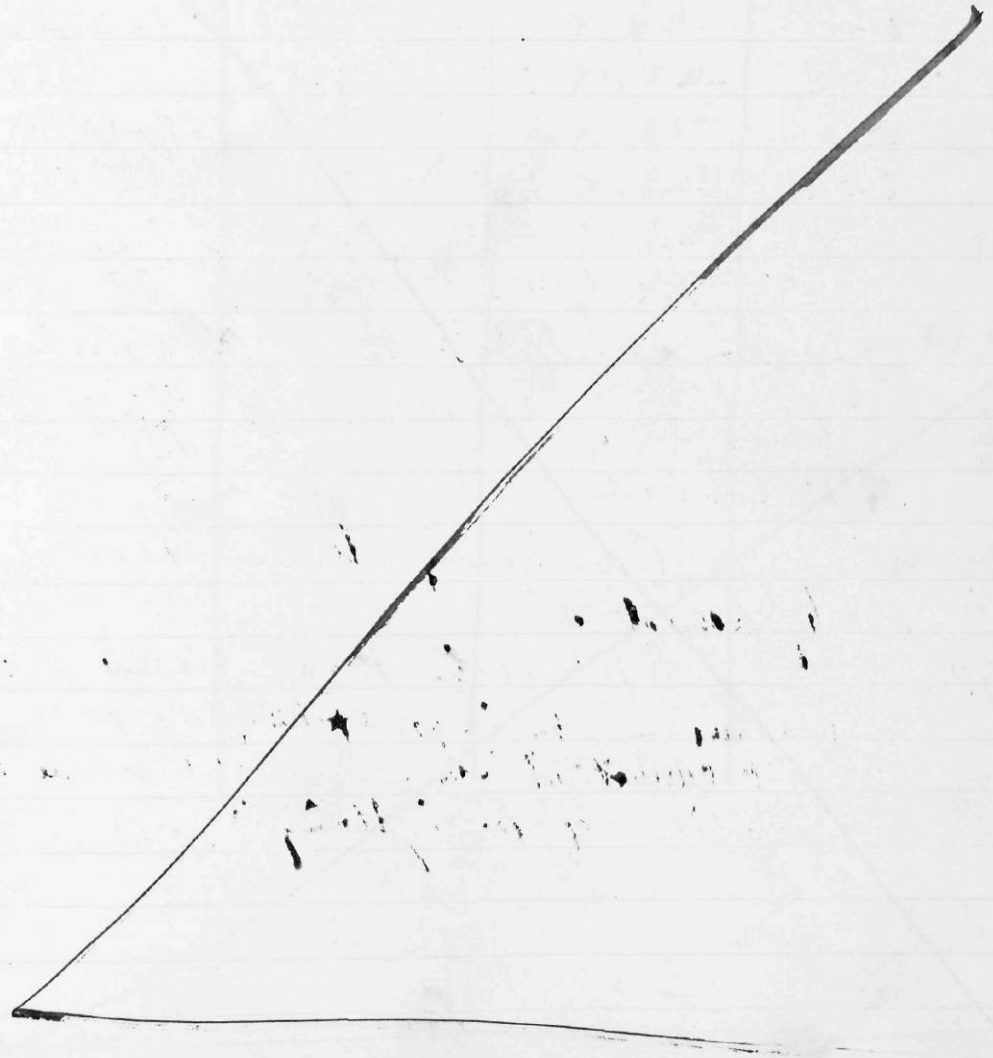
N.B. Mr. Ellis says: "I will make steel washers — bearings of hardened steel & so that grit cannot get in. — will make the least friction of anything".

1892 Dec 6th Tuesday at B,B.

Expt. 1 Five jars squash ✻ 1, 2, 3, 4, 5;
✻1. Sealed with Lard
✻2. " " Bees-wax
✻3. " " Parafine wax
✻4. " " Olive oil
✻5. " " Molasses

Expt 2 Material for copying letters
Glue. 40 grams.
Molasses, 10. " . will melt, in glue hot, with
10 grams of water

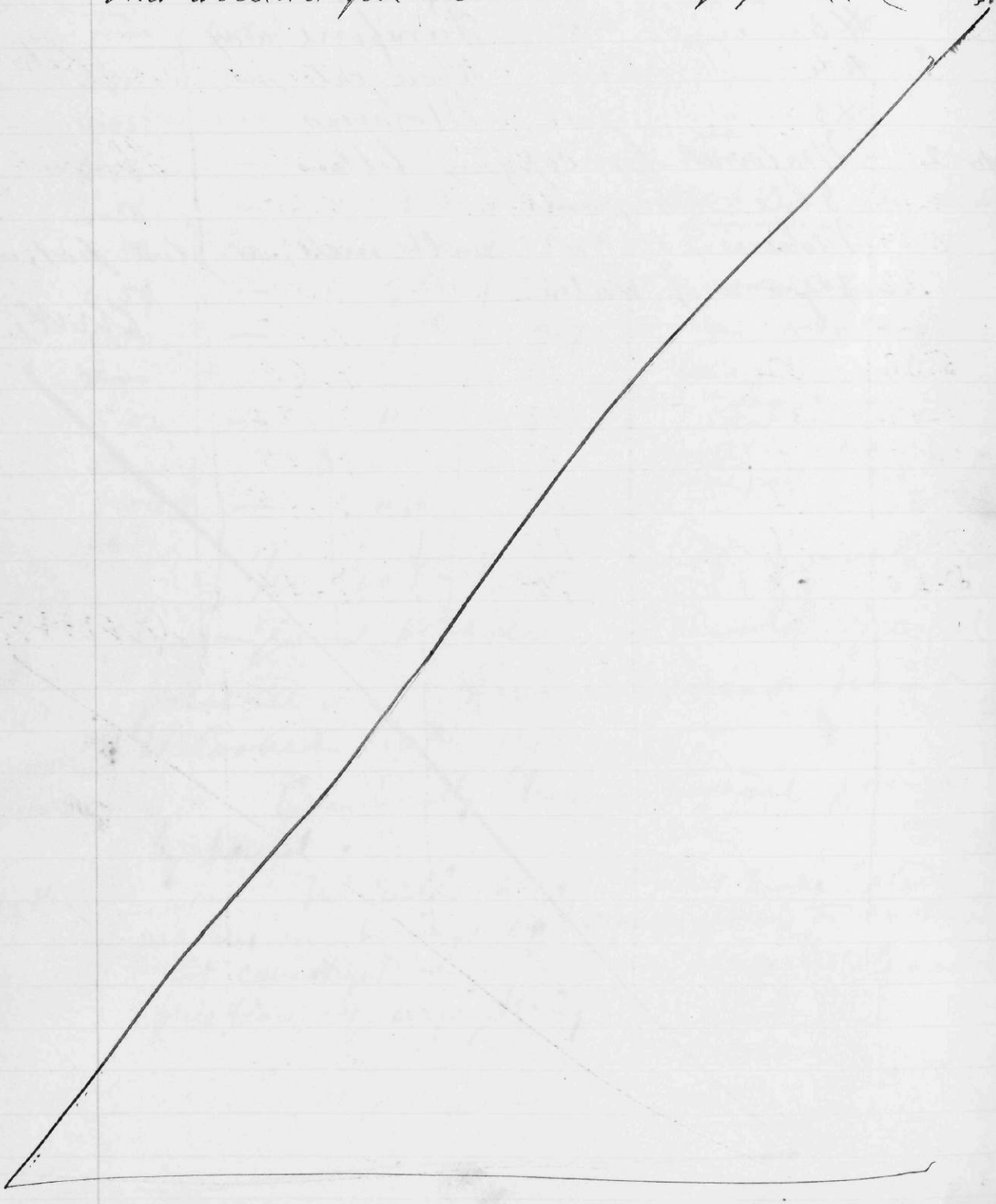
C.M.W.B.



1892. Dec 7th Wednesday at B.B. Lab.

Result – Ey 2° Pag 221. Material too hard, more M required

Ey 1 Glue 40. grams, Molasses 20. grams, Water 10. grams.
This would do for a cement in dry place. Gum.

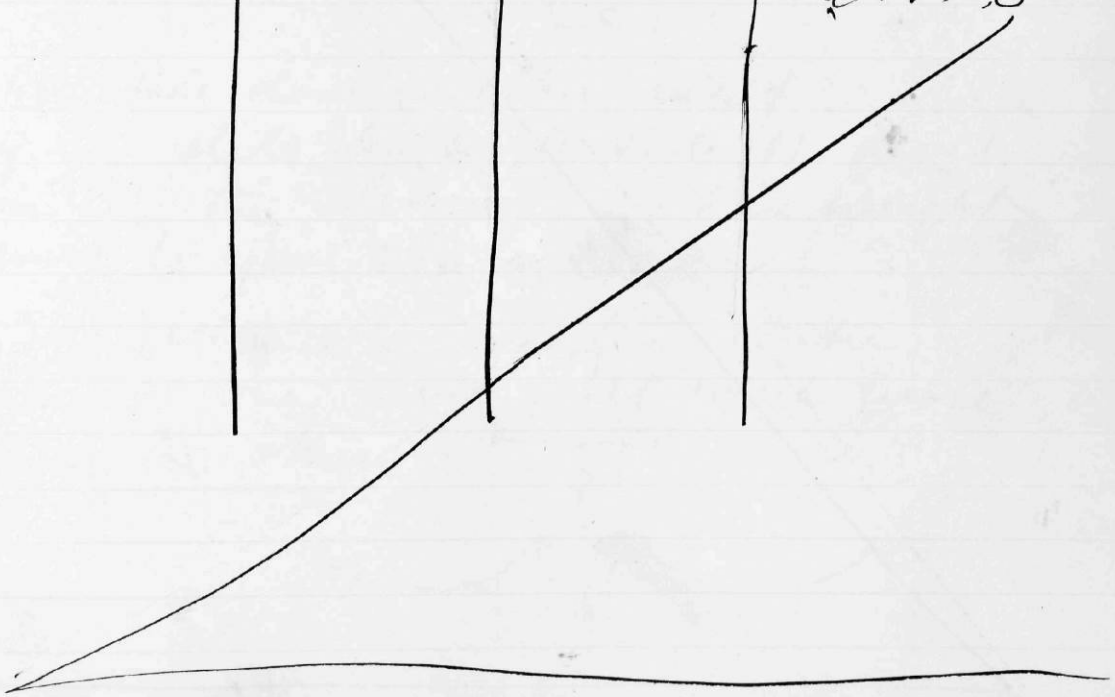


1892 Dec 8th Thursday at B.B. Lab

Expt 1 Glue 40 grams Molasses 40. grams
Result- Too hard
Expt 2nd Glue 40. Molasses 50

Time Fire started at - 5.10. Weight - 8.50. Kilo

	per ~~half~~ minute	frame 5 lb	weight	
5.20	17		8.30	Steam at 5.17
5.22	27	10. "	8.25	
5.24	33	20 "	8.02	
5.26	35	22 "	7.80	
5.28	34	20 "	7.75	
5.30	32	14 "	7.60	
5-32	30	18 "	7.50	
5-34	31	15 "	7.35	
5-36	30	16 "	7.25	
5.38	31	14 "	7.20	
5.40	27	15 "	7-15	



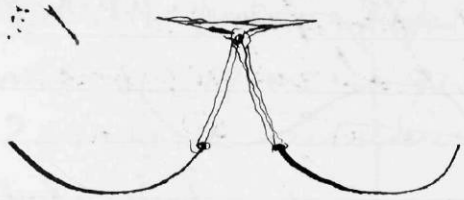
1892 Dec 9 Friday at B. B. Lab.

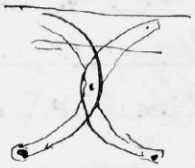
Expr 1 Glue 20 grams, Molasses 40 grams.

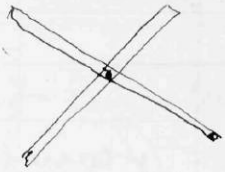
Expr 2 Glue 20 " " 50 "

B. M. H.

1892 Jan. 24 — Sat — at BB Lab.

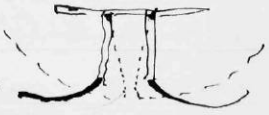




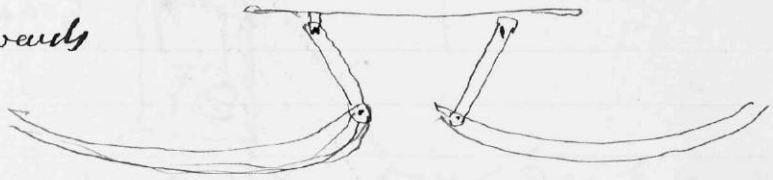


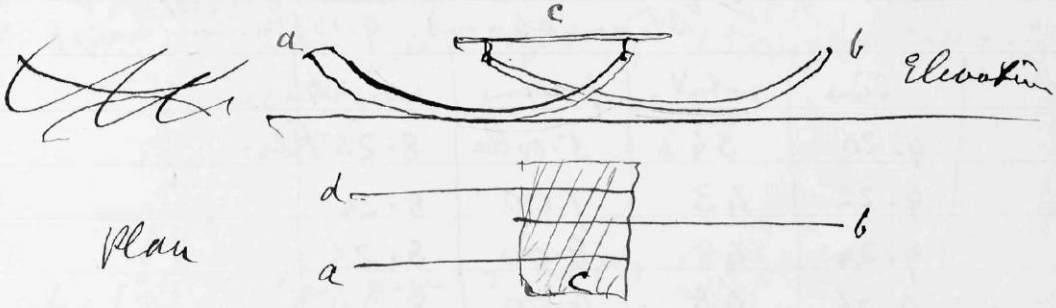
More nearly vertical

Make them exactly vertical ?



Slope inwards



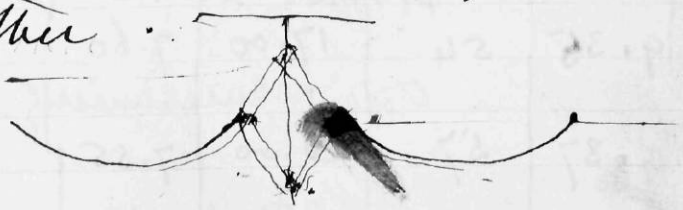


Elevation

Plan

One side double other is it? Then if any slide — single side (b) will do all the sliding. b in weight must be equal to (a + d).

Weight must be exactly in centre of pan or one curve will weigh more than the other.

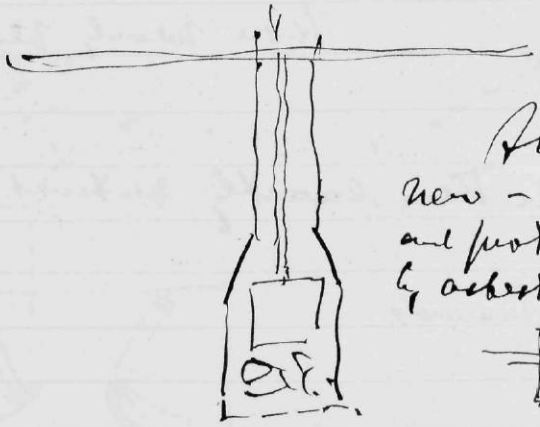


1892 Dec. 28 — Wed — at BB

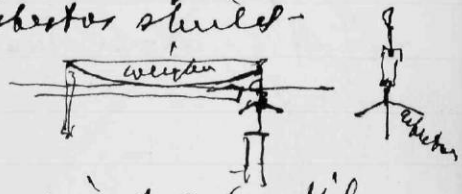
Exp. 1. Weil Try weighing flying machine with rotary.

ab = 6 ft.
cd = 13 inches.

Angle of wing from horizontal 15° upward.



Swivel joint & new - & hardened steel and protected from smoke & asbestos shield -



Fire lighted at · 9.09 p.m. weight 8.65 Kilo.
Steam shows. 9.15 p.m. — weight 8.51 Kilo.

Time	rotary.	pressure	weight	
9.20	34	5.00 lbs	8.25 Kilo.	
9.22	43	7.00	8.24	
9.24	48	8.00	8.23	
9.26	48	9.00	8.20	
9.27		Stopped mechanically	weight = 8.25 Kilo	
9.28	51	15.00	8.02	
		Stopped mechanically	= 8.050	
9.30	54	17.00	7.80	
		Stopped mechanically	= 8.000	8.00 7.760 0.040
9.32	56	17.00	7.76	
		Stopped mechanically	= 7.800	7.750 7.600 0.150
9.35	54	17.00	7.60	
		Stopped Mechanically	= 7.750	
9.37	57	20.00	7.55	7.700 7.550 0.150
		Stopped.	= 7.700	

Time	rotat	pressure	weight
9.40	53	19.00	7.50
	stopped mechanically –		7.53

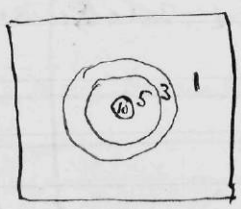
At conclusion of experiment after fire drawn – weighted machine down so as to read 7.55 then placed on machine brass weights = 150 grammes – scales then registered 7.70.

Result – Indications are that 57 rotations per min. gives a lift of 150 grammes.

6 ft diam.
3
18 ft circ.
57
126
90
velocity nozzle = 102.6 ft per min = lift of 150 grammes
= 17.1 ft per sec. = lift of 150 grammes.

1892 Dec. 30 – Friday – at N.Y. Lab.

Rifle match between Mr McCurdy, Mr. Ellis & A.G.B.



Three shots each – four each score

A.G.B.	A.G.B.	Ellis	McCurdy
Ellis		In Laboratory	
	20	20	20
	20	20	15
	30	20	20
	15	15	20
	85	75	75

Longer range – more than ~~twice~~ as far –

13	9	15
15	13	15
28	22	30

1823 May 22d Monday - at B. B. Lab

May 22d	Temperature of Lake	47°	of Atmosphere		58°
" 23d	"	"	48°	"	66°
" 24th	"	"	49°	"	59°
" 25.	"	"	49°	"	57°
" 26	"	"	48°	"	45°
" 27	"	"	48°	"	48°
" 28	"	"	46°	"	44°
" 29	"	"	46°	"	50°

1893 May 24 — Wed — at B.B. Lab

Testing mixtures of chlorate of potash and sugar.

Exp. 1. Five butter dishes. Each butter dish weighs 5⅞ grammes.

	Chlorate of potash	Sugar	Weight before burning	Residue after ignition
No. 1	4	1		
No. 2	3	2		
No. 3	2	3		
No. 4	1	4		
No. 5	5	5		

Each butter-dish (Nos 1, 2, 3, & 4) with its load (before ignition) weighs 62 grammes

Butter dish No. 5 weighs 67 grammes.

First applied match to Chlorate of potash alone — no result — did not burn. Then sugar alone — ditto — did not burn.

When ignited mixtures Nos 1 2 3 4, by match — All lighted well — (((((

No 1 seemed to burn most fiercely — (cracked its butter-dish in two) — Each succeeding one less fiercely & more slowly — No 4 very slowly — large amount of ash.

No. 5 — burned about same as Nos 2 & 3.

1893 May 24 – Wed. – at B.B. Lab.

	Before ignition	After ignition	Weight of ash	Appearance of ash
Pot. 1	62	58	1	Mere specks & very slight trace of chlorate left.
Pot. 2	62	58	1	a little ash
Pot. 3	62	58	1	a little more ash
Pot. 4	62	59	2	a large amount
Pot. 5	67	58	1	about same as Pot. 3.
Butter dish	57			

Exp. 2. Will now try large quantity mixed 4 parts of chlorate of potash and 1 of sugar.

Chlorate of potash	20 grammes
Sugar	5 grammes
Lid of tin-can	16 grammes
Before ignition. Total	= 41 grammes

After ignition whole thing weighs = 24 grammes
Tin can = 16
Residue = 8 grammes

What is left is simply chlorate of potash uncombined – a very slight trace of black ash – most of what is left is white.
This means too much chlorate of potash?
Noted May 24th 1893
ACG

1893 May 25th — Thursday — at KB Lab.

Exp. I. Ivy canthus mixture 2 parts chl. & pot. 1 part Sugar.

	Sugar	5 grammes
	Chlorate & potash	10 grammes.
2:1 KCl : Sugar	Lid & tin can	16 grammes
	Total before ignition	31 gm

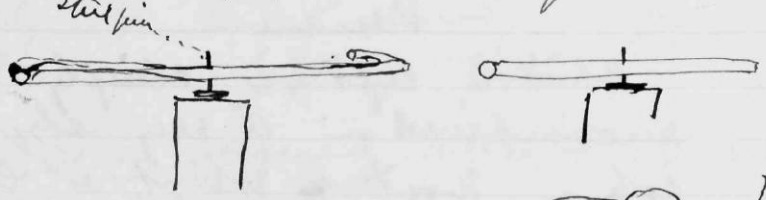
Total after ignition = 17 grammes
Reduct can = 16
ash = 1 gramme

Exp. II. S shaped brass pipe.

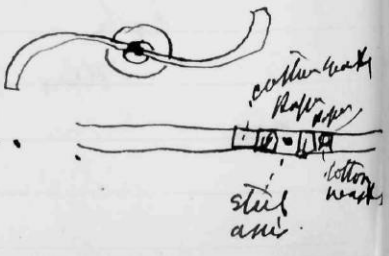
Distance a b = 16 inches
b c = 16 inches.

Ext. diam. of pipe = 1/2 inch. = 50/100 inch.
Int. diam. of pipe = 47/100 inch.

At b a steel pin 4 inches long (9/100 diam) put through pipe as axle. Plug of cotton waste at d and e. Both arms of pipe filled with mixture. Chlorate & potash : Sugar :: 2 : 1



Paper plugs just then cotton ~~bath~~ waste.



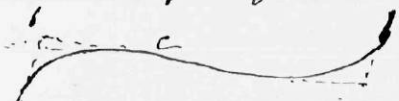
1893 May 25th — Thursday — at U.S. Lab.

Exp. II (continued) Mixture now being prepared.

Chlorate of potash	100 grammes.
~~Powdered~~ sugar	50 grammes.
Total	150 grammes.

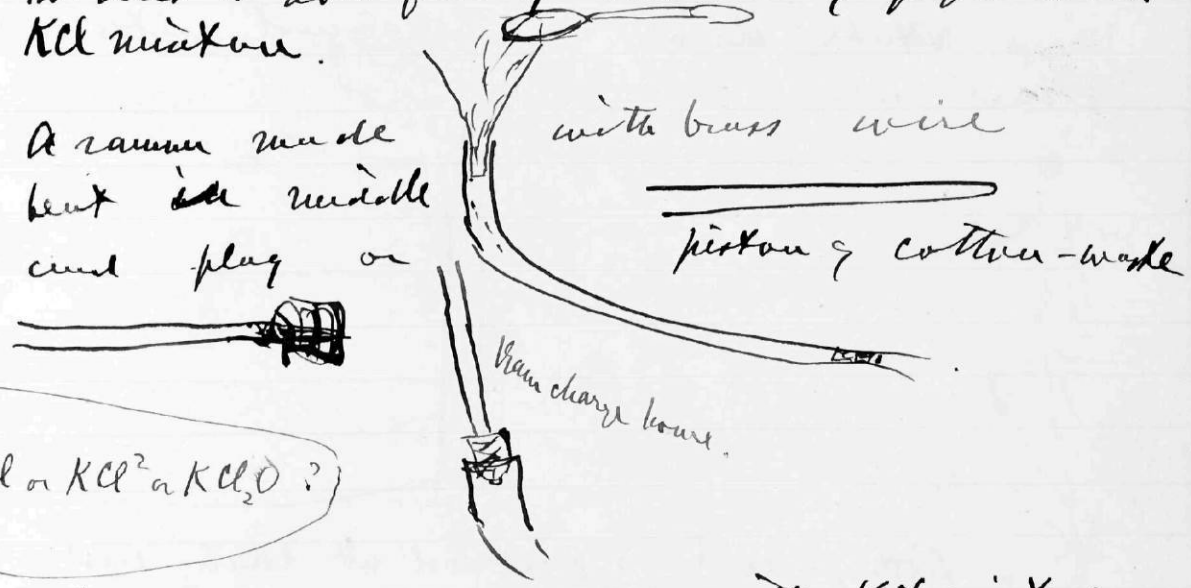
~~Wm. M. Ellis~~

~~Brass~~ tube empty — with only the paper and cotton waste plugs — weighs 195 grammes



Pipe not bent at a right angle. ∠abc greater than right angle.

W. Ellis is now filling one end of pipe with KCl mixture.



Is it KCl or KCl^2 or KCl_2O ?)

One half of pipe now filled with KCl mixture and rammed home. End plugged temporarily with a cork while other end of tube is being filled.

Two wires of rammer twisted together Rams better now. Other half of tube now filled with KCl mixture.

1893 May 25th — Thunder at Cliff Lab.

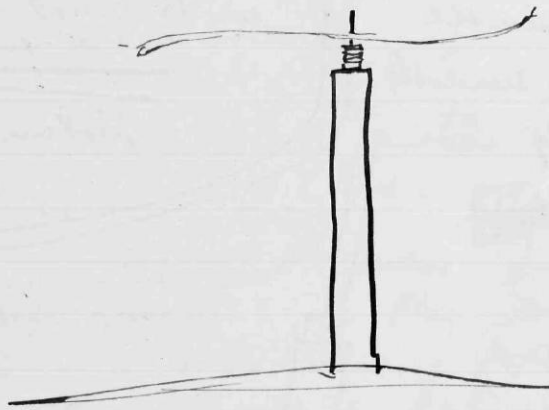
Exp III continued.

Next tube weighed — full of chlorate & potash mixture and corked at ends,

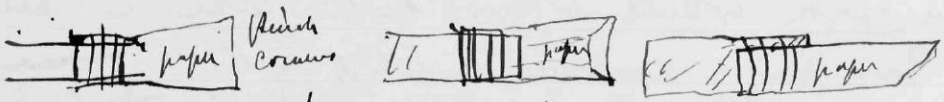
Full tube	=	265 grammes
Nearest empty tube	=	195 grammes
Chlorate & potash mixture (& corks)	—	70 grm

Weight of corks insignificant — ~~four~~ two corks do not weigh one gramme — ~~both cork plugs~~ each plug corresponds to half a cork — both together then may weigh ½ gramme.

Tube now pinned on end of a wooden stake driven into ground outside Laboratory,



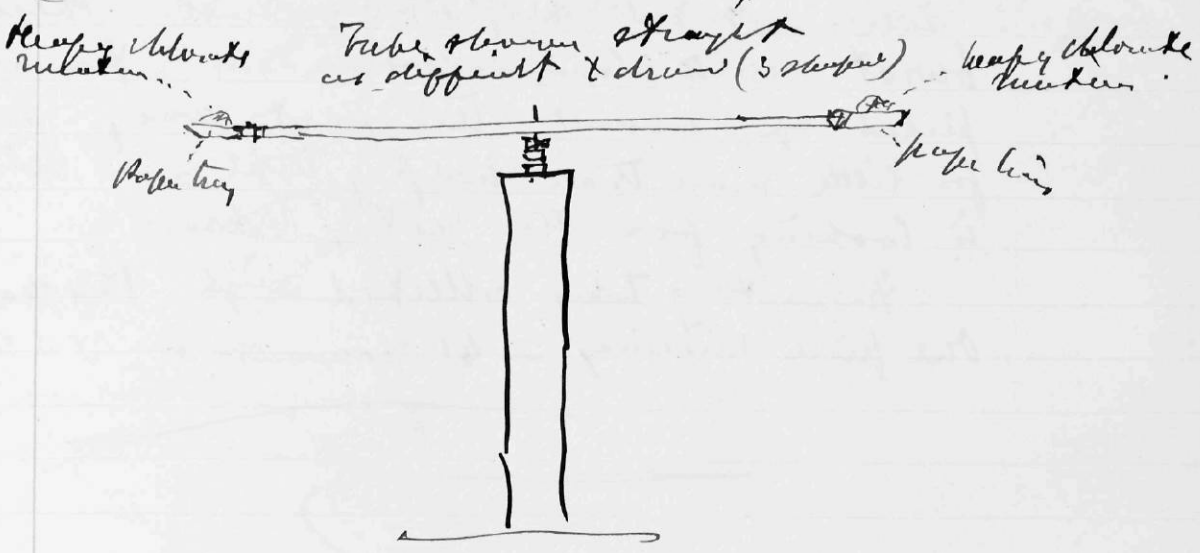
Little paper trays fastened at each end of tube —



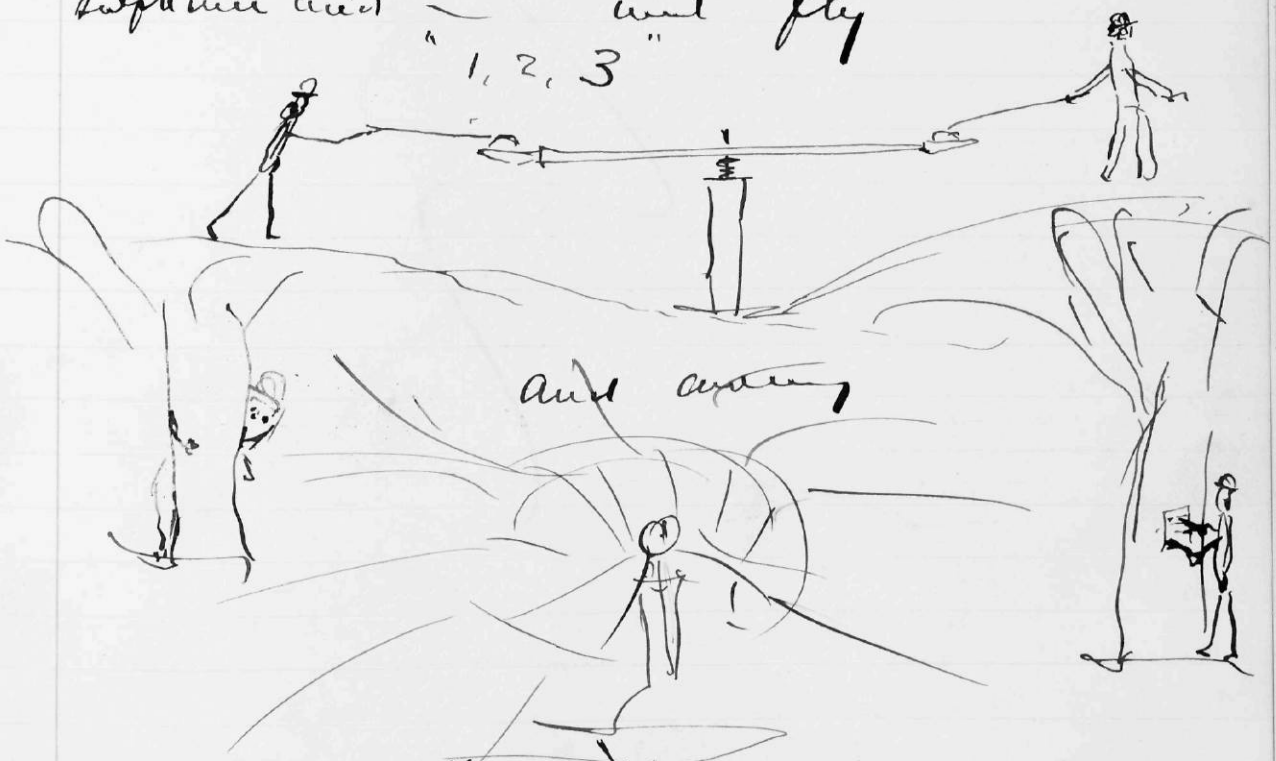
Cork removed from end of tube and heap of chlorate & potash mixture placed in paper tray communicating with mixture in tube.

1883 May 25th — Thursday — at Kk. Lab.

Expt II (continues) Paper tray at either end.



Mr. Ellis & I will touch off each lamp by means of iron rods. Each rod dipped into sulphuric acid. Mr Signal will simultaneously touch off Chl. & Pot. Mixture with sulphuric acid — and fly



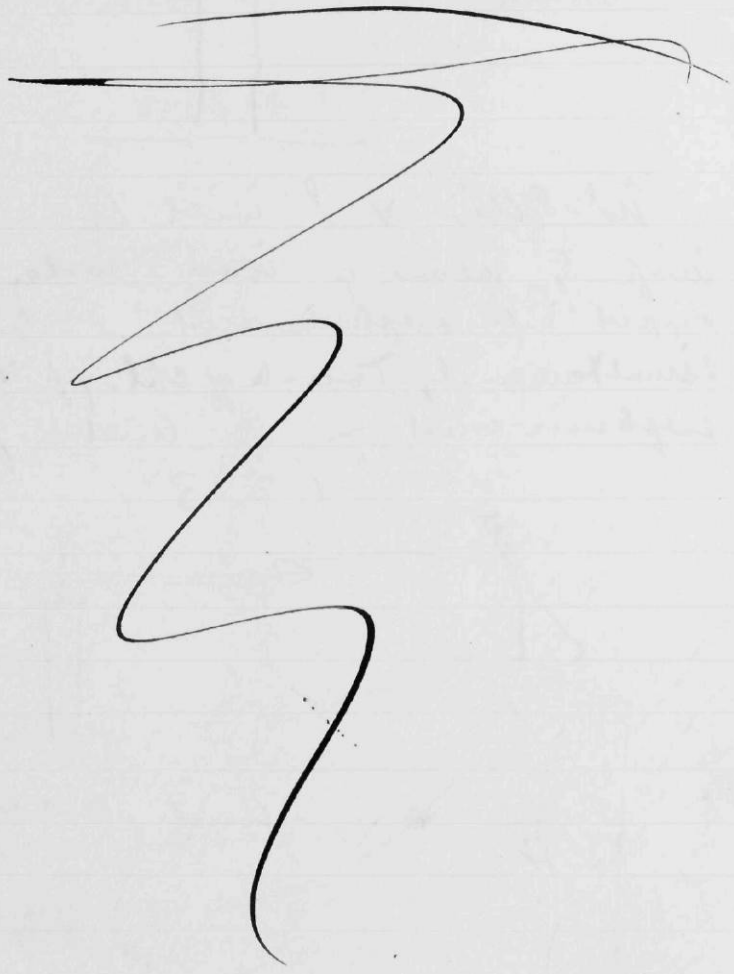
Now we will try it — and note results.

1893 May 25th – Thursday – at Bickerhall.

Exp. II

Result Touched up mixture O.K.
Tube rotated very slowly and then burst with loud explosion. Fragments picked up about the yard every account for little more than half of tube – Mr. Ellis is looking for the rest of tube.

Fragments of tubes collected with 154 grammes
One piece missing = 41 grammes.



1893 May 25th Thursday — at B.B.
A rocket case filled with chlo-Pot and Sugar.
burnt, without going up.

1893 May 26 — Friday at B.B. Lab.

Results of experiments in preserving vegetables.
" Jars filled Oct. 5 — 1892 — see p. 172
Jars filled Dec. 6 — 1892 — see p. 221

Jar of cauliflower filled Oct. 3 (see Exp. 1 p. 187) looks O.K. but liquid has a decidedly pinkish look — very different from all the jars subsequently filled. A bubble of air  about 1½ inch long by ½ inch wide —

Will now open jar — Sufficient)+(OC) ! Smell "fit to knock you down" says W. Ellis.

All the jars of cauliflower filled Oct 5 — look O.K. but liquid half out of jar and hence I presume they are bad. Will open the best looking jar.

Open jars of cauliflower No 2 & No 9. Little air-space — on opening jars — a gush of bad-smelling gas came forth — but cauliflower seems O.K. We have washed cauliflower in cold water — and it seems fresh and sweet.

All the jars of cauliflowers &c — show air-space with the exception of 5 jars of squash. Each of these jars stands bottom side down in a tin cup —  and these are the only jars having the tin cup. — No —

There is one jar of Squash standing in an ordinary tin cake —  containing olive oil which has kept and keeps — Squash evidently bad. It is marked " Oct 1892 sealed with olive-oil " in Mr. Ellis' writing but no reference to notes.

Another jar of Squash is marked same way and looks O.K. No un-opened jar — "Mustard" Oct 1892 sealed with olive oil ".

The other four perfect looking Squashes are marked " 1892 Dec. 6 p. 221 " No 2 3, 4, 5. By reference to p. 221 I find that there should be another jar of this series — but we cannot find it anywhere.

No 2 sealed with bees-wax
3 " " paraffin wax
4 " " olive oil
5 " " molasses

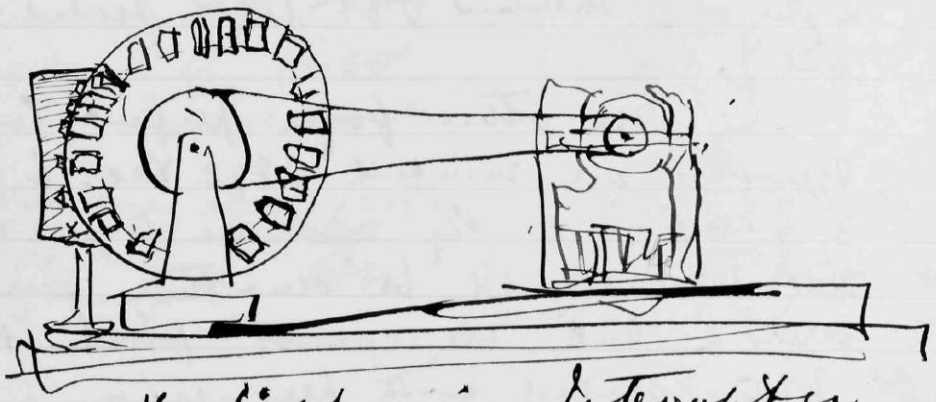
— Looks O.K.

Will now open jar No. 4 sealed with Olive oil and note condition of contents.

Jar red of olive oil by pouring in water. Oil smelled rancid. — Jar was found tightly sealed — and on opening entirely smelled nice & fresh — Will have this Squash cooked.

1893 May 27th — Sat — at BB Lab

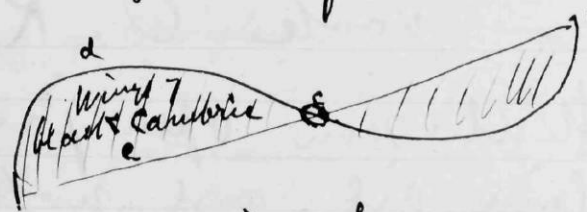
W. Ellis fixed water-wheel — found large stick of wood in water-pipe. This had retarded flow of water. Water-wheel works O.K. now. Attached Radioplectric Interrupter to a small Tesla (Tesla) motor so that it could be worked by dynamo



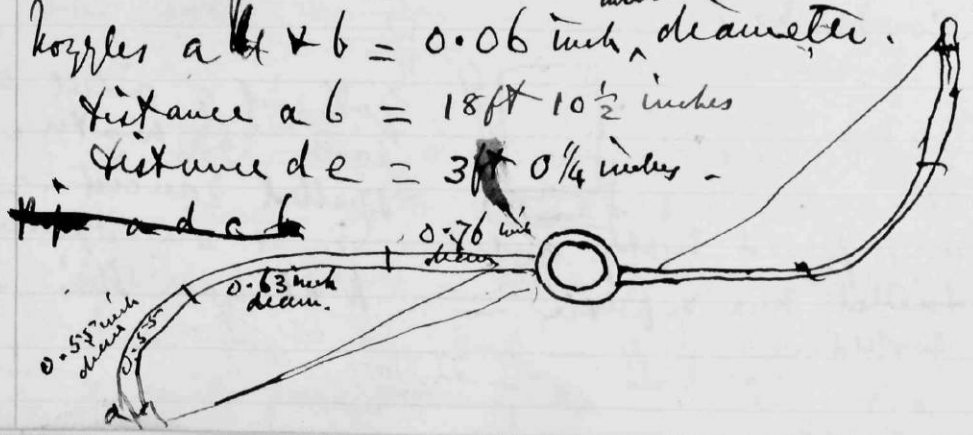
Radioplectric Interrupter

"Radiotone"? or "Hertzo-tone" or "Thermo-tone"

Going to try new boiler for rotating wings

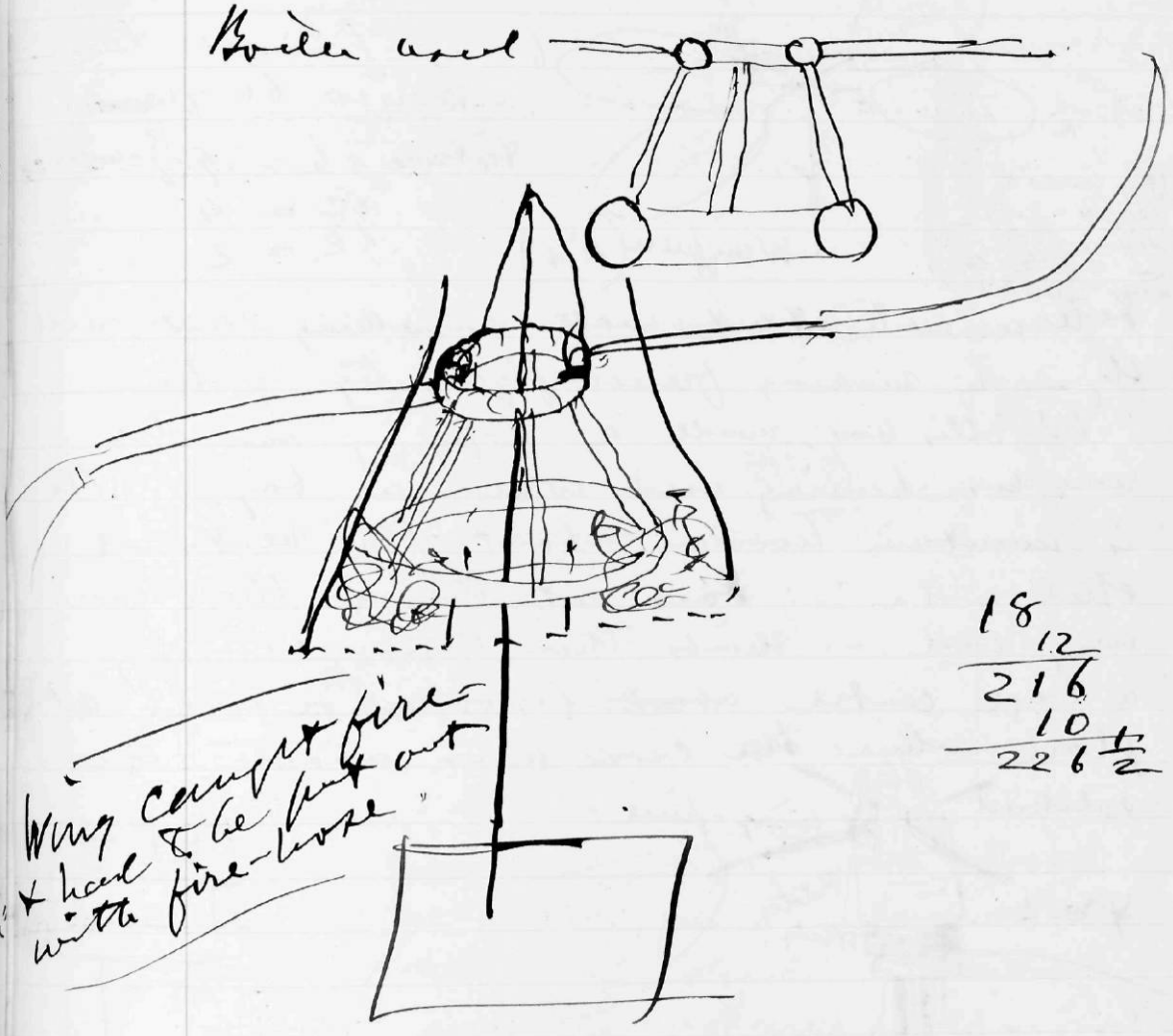


Nozzles a b = 0.06 inch internal diameter.
Distance a b = 18ft 10½ inches
Distance d e = 3ft 0¼ inches.



1893 May 27 — Sat — at Bells Lock.

Boiler used



Wing cowpat fire
+ head to be put out
with fire-hose

18
12
216
10
226 1/2

10 rotations in 5·5 seconds
1 rotation = 5·5 seconds
Diam. of circle = 18ft + 10½ inches = 226 ½ inches
Circumference = Diam. × 3 times about = 679½ inches
Velocity of nozzle 679·5 inches in 5·5 seconds.

6795 = 55 : 6795 (: 1

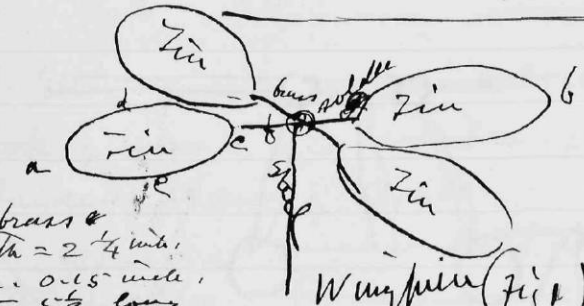
55) 6795 (123 inches per second
55
129
110
195
165
30

Speed of nozzle 10¼ ft per second

10ft + 3 inches per second.

1893 May 30th. Tuesday — at 28 Lab.

Exp. 1.



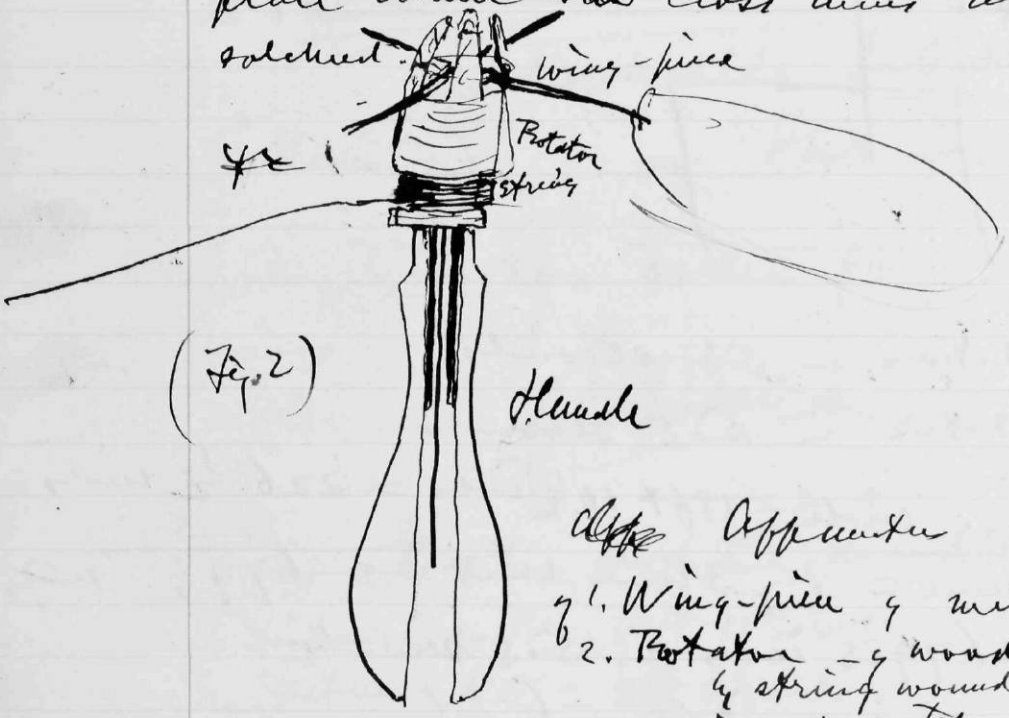
Wing-piece (Fig 1)

Weight 66 grammes.
Distance ab = 9 3/8 inches
ac = 4
dc = 2

Wire (of) brass
length = 2 1/4 inch
diam. = 0.15 inch
Steel rod — = 5 1/2 long
diam. = 0.06 inch

Determined to start with something that would fly — by making French flying toy of tin.

Mr. Ellis has made a copy of one he remembers having used when a boy. He is uncertain however about the vertical steel rod. Does not think there was any rod — thinks there was simply a large centre (wooden or cork) at place where cross arms about are pivoted.



(Fig. 2)

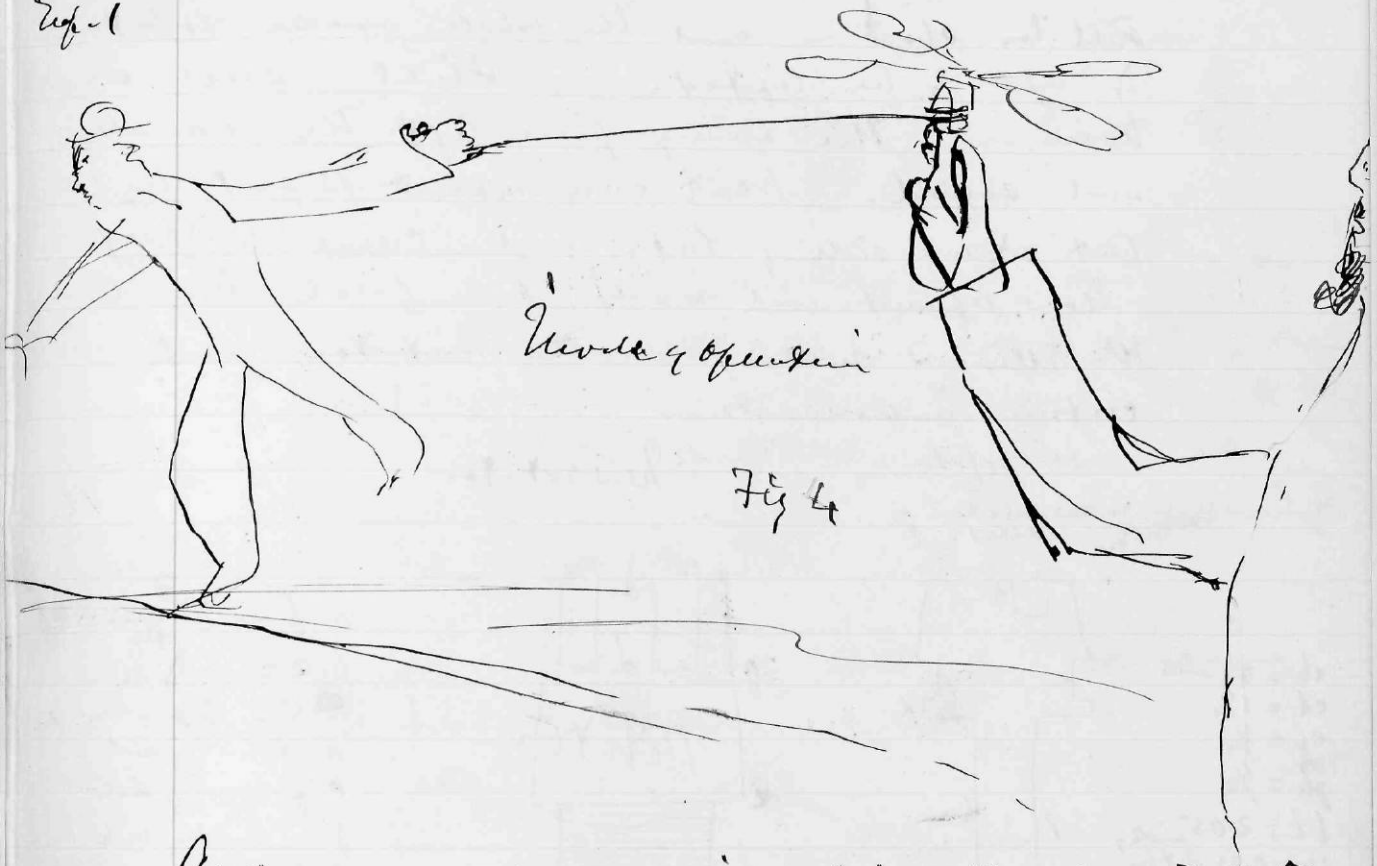
(Fig 3)

Apparatus consists of

1. Wing-piece of metal
2. Rotator — of wood — Rotation caused by string wound round rotator as round a top — and
3. a handle of wood.

1893 May 30th – Tuesday – at Bk Island

Engr-1



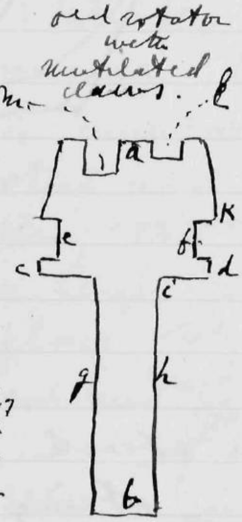
Mode of operation

Fig 4

At first cross-bars & wing-pins stuck in the claws of the rotator-arms when string was free – lifted up wooden rotator – but did not succeed in clearing itself. At first vertical steel rod projected below cut off the claws of rotator so as to leave claws little more than 1/8 of inch projecting. Then the wing-pins were not held firmly during rotation but slipped out. On account of one cross-bar overlapping the other – it was found that the slots in rotator only held over the cross-arms – other cross-arm sing above head. Filled down one pair of slots lower than other (see Fig 3 p. 242). Cross-arms then held better. Vertical steel rod which had projected below handle at first – was cut off so as to leave it only 5-1/2 inches long. Claws of rotator

1893 May 30th — Tuesday — at BH Lab.

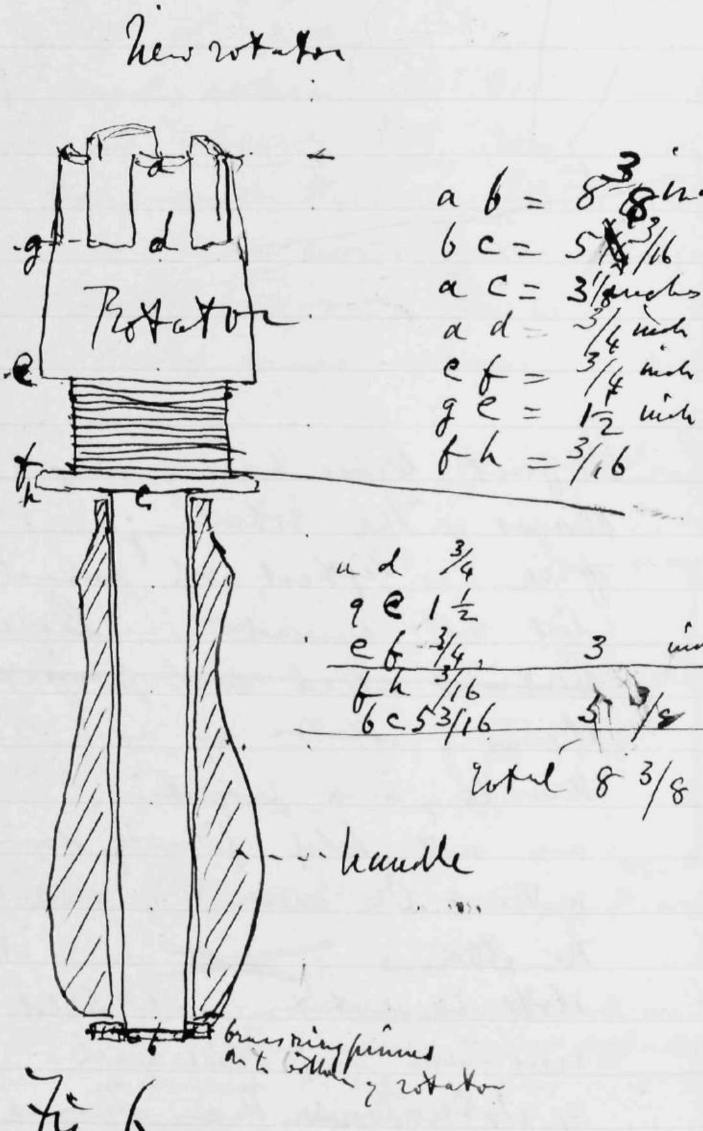
still too short — and the whole wooden rotator is apt to be lifted. Still — once or twice — the wing-piece left the candle and soared. Went over about 15 feet high but struck side of lab. and came to grief.
Now repaired and ready for fresh trial.
Mr Ellis is making another rotator with certain improvements



ab = 3½ inches
cd = 1¼
ef = ¾
gh = ½
bi = 2.05 width
dK = 0.38 slot for thread.

depth g l = 0.25
depth g m = 0.32
width g l = 0.33
width g m = 0.33

Fig 5



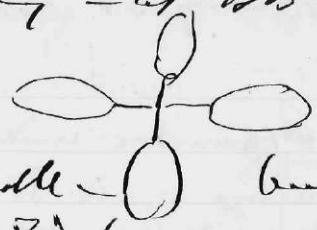
a b = 8 3/8 inches
b c = 5 3/16
a c = 3 inches
a d = 3/4 inch.
e f = 3/4 inch
g e = 1½ inch
f h = 3/16

a d 3/4
g e 1½
e f 3/4. 3 inches
f h 3/16
b c 5 3/16 5 3/8.

total 8 3/8 O.K.

Fig 6

1893 May 30th — Tuesday — at WB Lab.

Exp. 2 — Same wing piece —  as in Exp. 1 — ~~Same~~ same handle — ( ) but new rotator shown in Fig 6.

Result — Wing-piece flew into air at least 25 ft ~~high~~ up — first attempt — Rotated well & came down with steel-shaft vertical. Tried it several times — O.K. Showed experiment to Mr - & Mrs Martin. O.K.

Exp. 3. Removed one pair of wings leaving other two about.

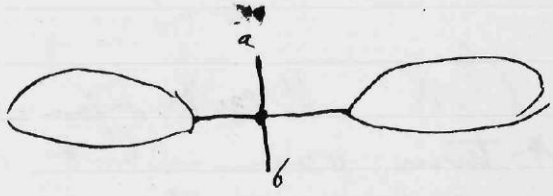


Fig 7.

Result: — Rose out of rotator and immediately turned a somersault — falling head first on ground. Tried it several times with same results.

arrowheads in Fig 6 show action of apparatus

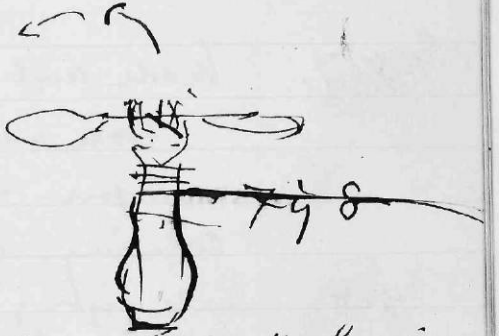


Fig 8.

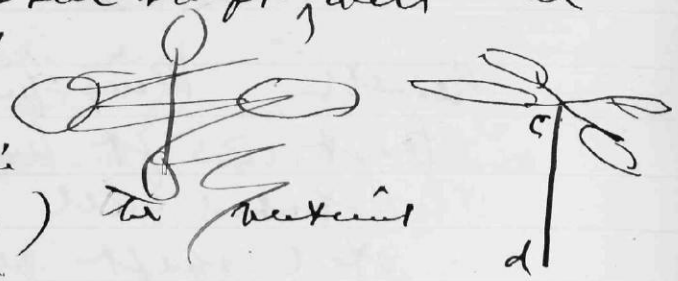
Exp. 4. Removed cross-bar (ab Fig 7) and tried again. Though good rotation wing-piece refused to mount after leaving the rotator — Simply turned a back somersault & fell to ground.

All our steam & gunpowder experiments have been made with two wings not four — The rocket apparatus acted in this way — My four wings with rockets.

B. 3

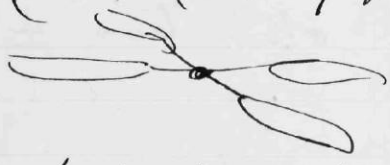
1893 May 30 — Tuesday — at Gb Lab.

Exp. 5. Apparatus will now be tried with four wings again to see if all is O.K — and then the vertical steel shaft (cd) will be removed — and experiment repeated in order to ascertain what effect (if any) the vertical shaft cd has.



Rotated beautifully with steel shaft (cd) went up about 50 feet.

Exp. 6. Cut off the shaft (cd) (weight 4 grammes) — leaving wings alone



O.K. Went up beautifully — did not turn over — but appeared to keep horizontal as well as when rod cd was present: Went up at least 50 feet — if not more — Angle of wings seemed to be about ~~50 degrees~~ 15 degrees ——

Exp. 7. Made angle of wings 45°

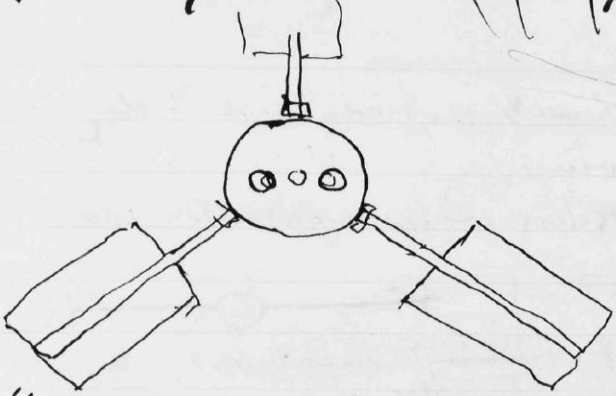
Rose well — but not to so great a height as before — Rotations stopped sooner — wobbly coming down. (Rose about 25 ft.)

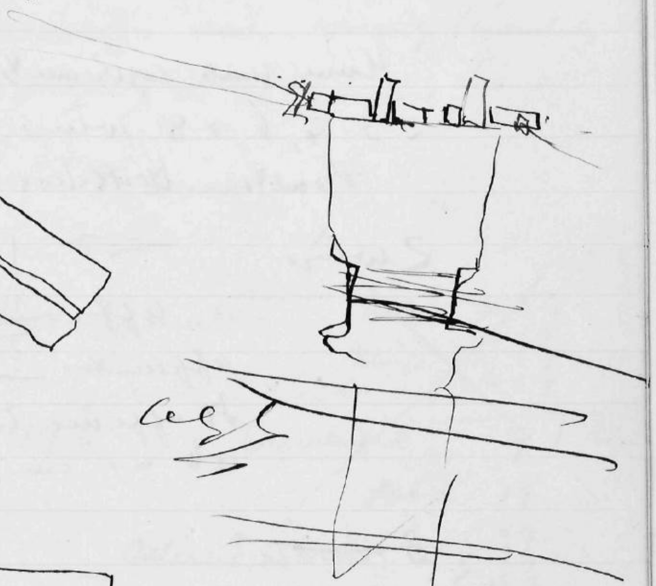
Exp. 8. Made angle of wings as small as possible = think about 5° (——•——). Result: — Beautiful rotation — did not rise above 15 feet — but continued in rotation for very much longer time than in former experiments and floated along like a feather — drifting with the wind — and fell softly about 100 yards away.

RJ May 30th 1893

1891 May 31 — ~~Tuesday~~ Wed. ([illegible]) — at Bks Lab.

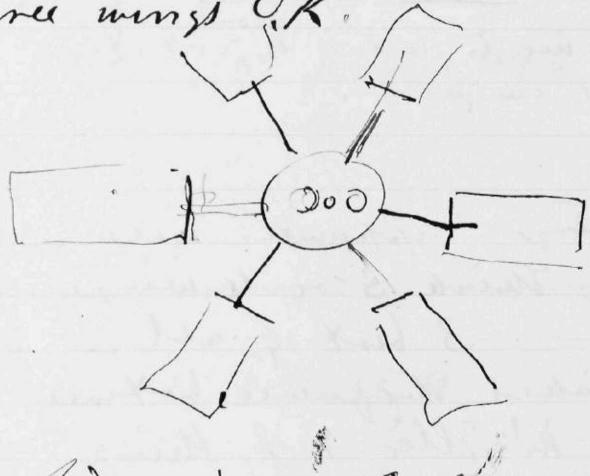
Exp. 1.



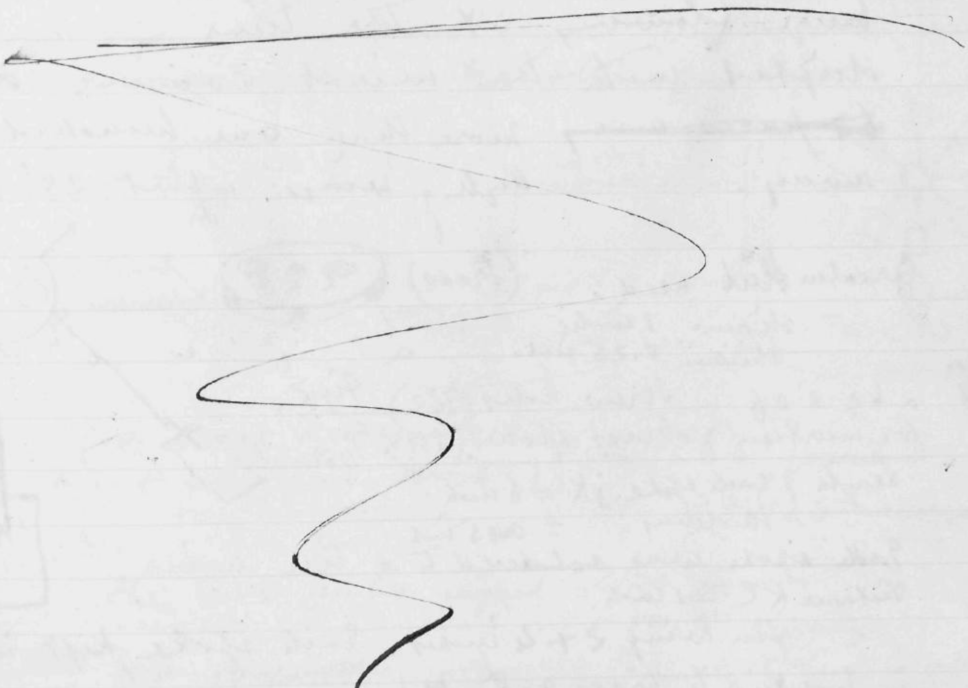


Three wings O.K.

Exp. 2.



Six wings O.K.



1893 June 1 — Thursday — at Elk Lake

Have made experiments yesterday and today with 2, 3, 4, 6, & 8 wings.

Results: With two wings apparatus will not rise.

2 wings.

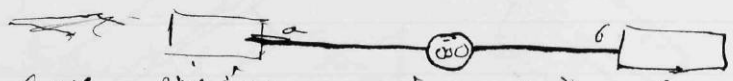


Fig 1

After ~~rising~~ ~~tumbles~~ sufficiently to clear rotating apparatus ~~goes~~ at once to the ground. It appears to have a slow rotation about ab as an axis.

~~3 wings~~

With 3, 4, 6 & 8 wings apparatus rises into the air well. Think 3 or 4 wings better than 6 or 8 — 3 best of all — but not any very marked difference between 3 & 4 wings. Mr. Eller & I think that with 3 or 4 wings apparatus rose about 75' feet into the air. Like a strong breeze blowing at the time — and apparatus drifted with the wind coming down ~~at the~~ ~~to pass away~~ more than one hundred paces away. Angle of wings about 25° with horizon.

Circular disk used: (brass)
diam 1 inch
thickness 0.25 inch.

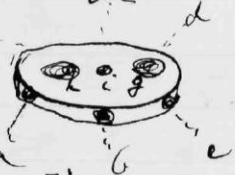


Fig 2.

a b c d e f — Screw holes (Fig 2) for insertion of brass spokes (as in Fig 3)

Length of each spoke jk = 6 inch.
Thickness = 0.15 inch.

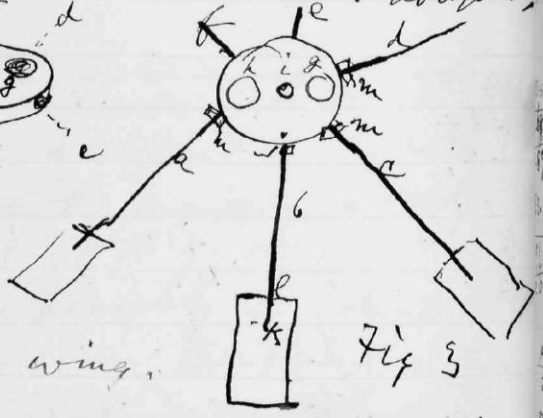


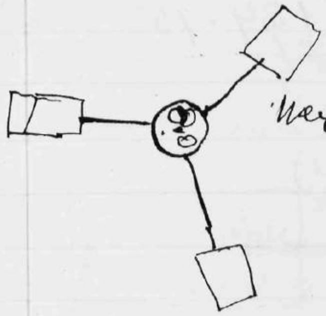
Fig 3

Each spoke was soldered to a tin wing.
Distance kl = 1 inch.
Tin wing 2 + 4 inches. Each spoke kept in ~~place~~ firmly in position by brass nut (m).

1893 June 1 — Thursday — at B.W. Lab.

Weight of  one wing (including one spoke, one nut & one tin blade) = 34 grammes.

Weight of ~~hub~~ brass hub. = 19 grammes.



Weight of three winged apparatus

Weighed 119½.

~~Hub. = 34~~
~~Wings = {19, 19, 19}~~
~~Calculated 91 gram~~

Hub = 19
Calculated Wings = {34, 34, 34}
121 gram

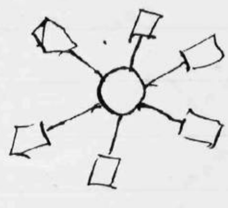
20)120(5
120

285
119½
165½

---

wing surface = 6×8 = 48

48)220(4.5
192
280
240
400

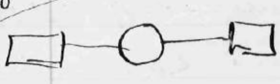


6 winged app. = 220 grammes (weighed)

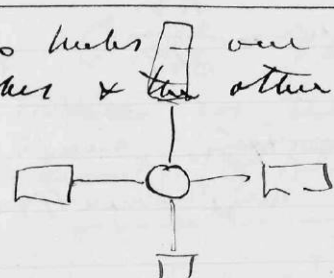
Hub 19
6×34 = 204
223 grammes

4×8 = 32
32)152(4.75
128
240
224
160
160

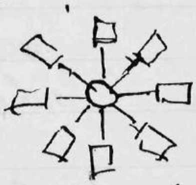
We have two hubs — one pierced with screwholes for six ~~wings~~ spokes & the other for eight.



weighed = 86 grammes



weighed = 152



weighed = 285.

one wing 64)285(4.45 grams p. sq. in. W.S.
256
290
256
340
320
20

33.5
8
268.0
19
287.0

33.5
6
201.0
19
220.0

The eight wings by themselves without any hub.  } = 8)265 grammes

33.125 average weight of wing

19 / 8 [illegible] 33.3 / 19.9 / 2.17 / [illegible] / 219

33.5
4
134.0
19
153.0

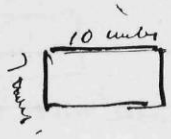
W.

The two hubs weighed = 2)39 grammes

19.5 average.

~~288~~ ~~Steel~~ ~~Steel rod~~ Steel rod to be screwed on vertically to hub if desired weighs 19 grammes: ~~length~~ Length 8.75 in. diam = 0.13 inch.

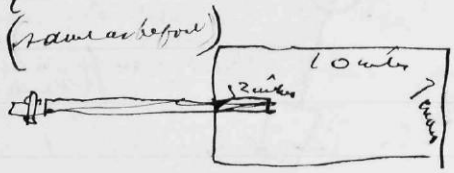
1893 June 1 — Thursday — at USB Lab.

4 pieces of tin cut out 

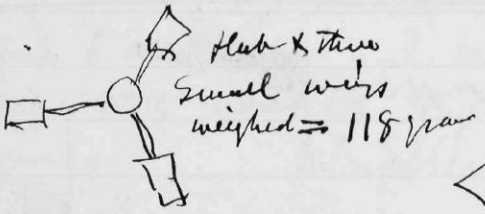
7×10 inches — for large wing pieces.

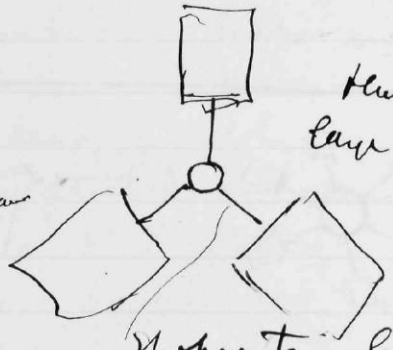
The 4 pieces of tin weigh = 4|519 grammes
average. 129.75 grammes

Three of these pieces of tin have now been soldered to brass spokes (same as before)



Will now try the small and large wing-surfaces comparatively.





Difference = 467 − 118 = 349

Spokes too light — bent & twisted somewhat attempts were made at rotation.

Small wings area (2×4)×3 = 24 square inches wing surface
Large wings area 7×10) ×3 = 210 " " "

$$\frac{\text{Weight of small wing piece}}{\text{area of wing surface}} = \frac{118}{24} = \frac{59}{12} = 4.91 \text{ grammes per square inch}$$

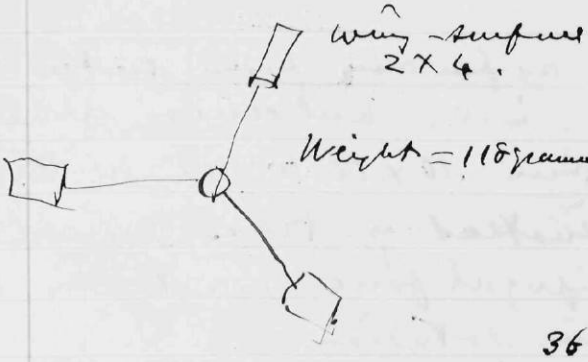
118
46.

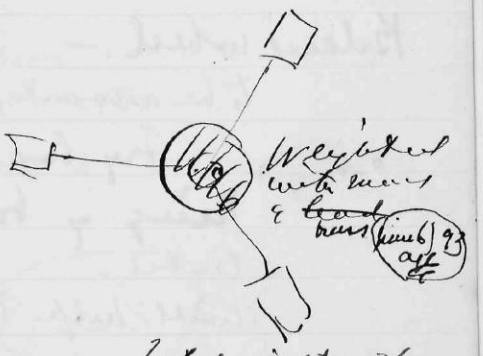
$$\frac{\text{Weight of large wing-piece}}{\text{area of wing surface}} = \frac{467}{210} = 210\overline{)467}\,(2.22 \text{ grammes per sq. inch}$$

420
470
420
500
450
3 rows 200
250

129.75 3 | 130 3 / 39 0 / 4 | 210 / 840 / 390 / 450

1893 June 1 — Thursday — at Bk Lab.

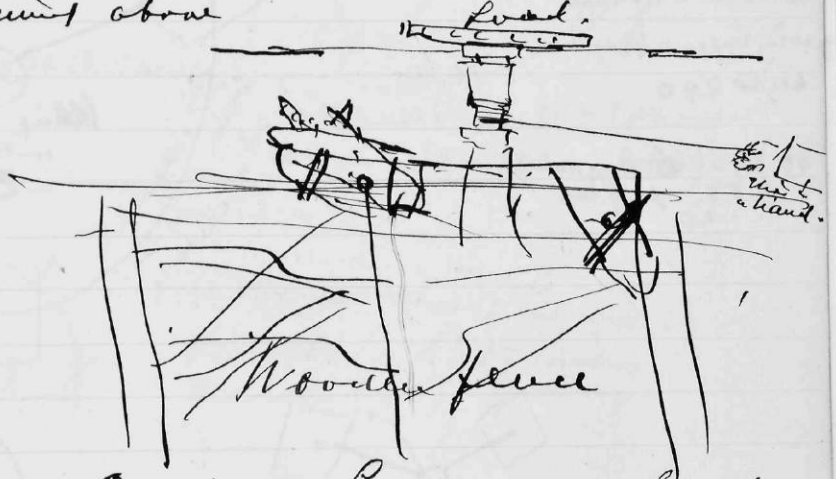




360
118
Load = 242 grammes
118
124

The load is carried above

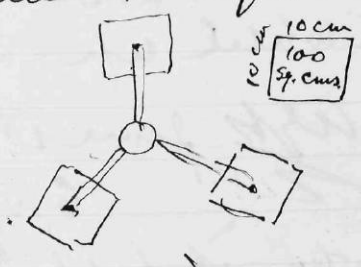
118
2
236

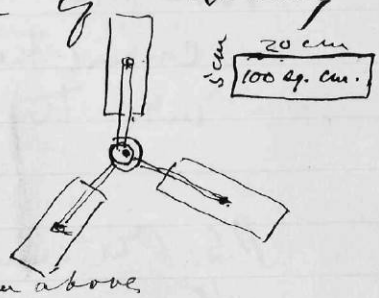


Result. Yes O.K. Lifted a load more than twice as heavy as itself. Raised it about 8 feet in the air.

Experiment upon shape of wing.

10 × 10 cm = 4 × 4 wings.
4 × 4 × 3 = 48 sq. inches
2 wing surface.
weight = 160 exp. 252
48) 160 (3.3
144
160





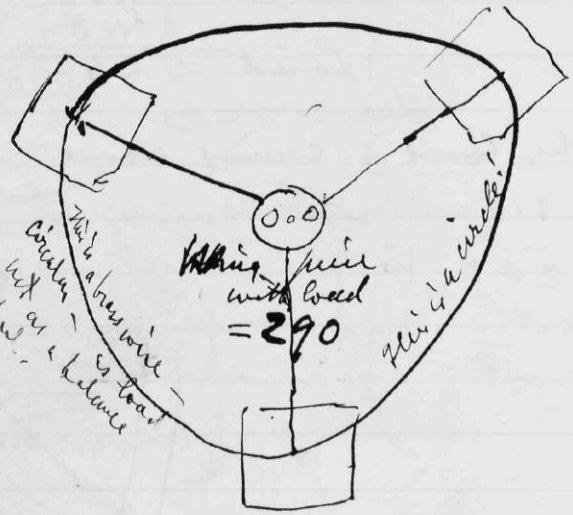
Three 10 × 10 cm wings — arranged as shown above.
Three 5 × 10 cm wings — " " " "

Result: Square wings seemed [illegible] to give best results yet obtained. The 5 × 10 wings went up well — but think less efficient than 10 × 10. Made noise like whirring of partridge — sustained cruise sooner than other. The 10 × 10 wings sailed away gracefully at least 50 ft high — cruise & power & grace not possessed by other.

1893 June 1 — Thursday — at Bl. Lab.

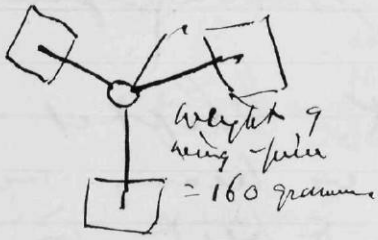
Balance wheel — Mass — as far away from centre — seems to be advantageous — i.e. balance wheel.

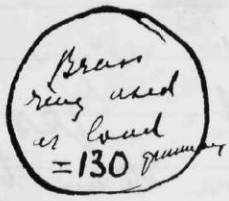
Try loading one 10×10 wings with a ring of brass instead of brass weight at centre. Centrifugal force generated in load will help to sustain rotation.



Ex
10×10 Cm = 4×4 inch
wing surface = 16 sq. inches
weight 290

48) 290 (6.0 grammes per sq. inch
288
.20





~~Ring of brass~~

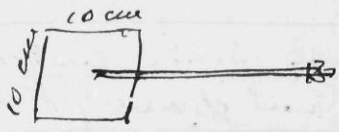
Brass ring
Diameter = 11 inches
Thickness of wire = 0.16 inch
Weight = 130 gms.

Result — O.K. The 10×10 wings carries the balance wheel up about 10 feet into the air.

Ayrton June 1st — 1893
C, W, H, E June 14/1893

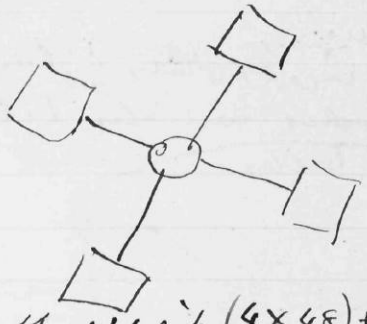
P.S. One wing broken when it fell to ground. Have marked appropriate & sent away to museum. Ayrton June 1st — 1893

1893 June 3 — Rel. of 185 Lab.

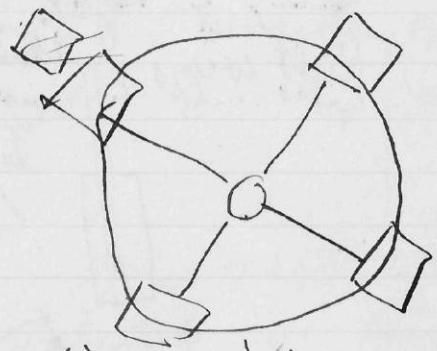


weighs 48 grammes

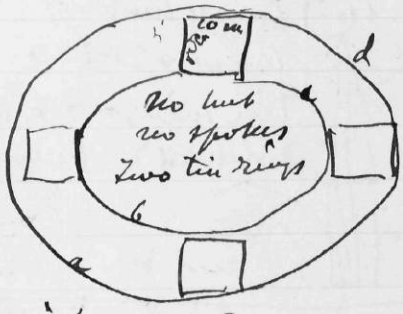
4
192
18
210



should weigh (4×48)+18=210



With brass ring (p. 252) should weigh 210+130=340 grammes

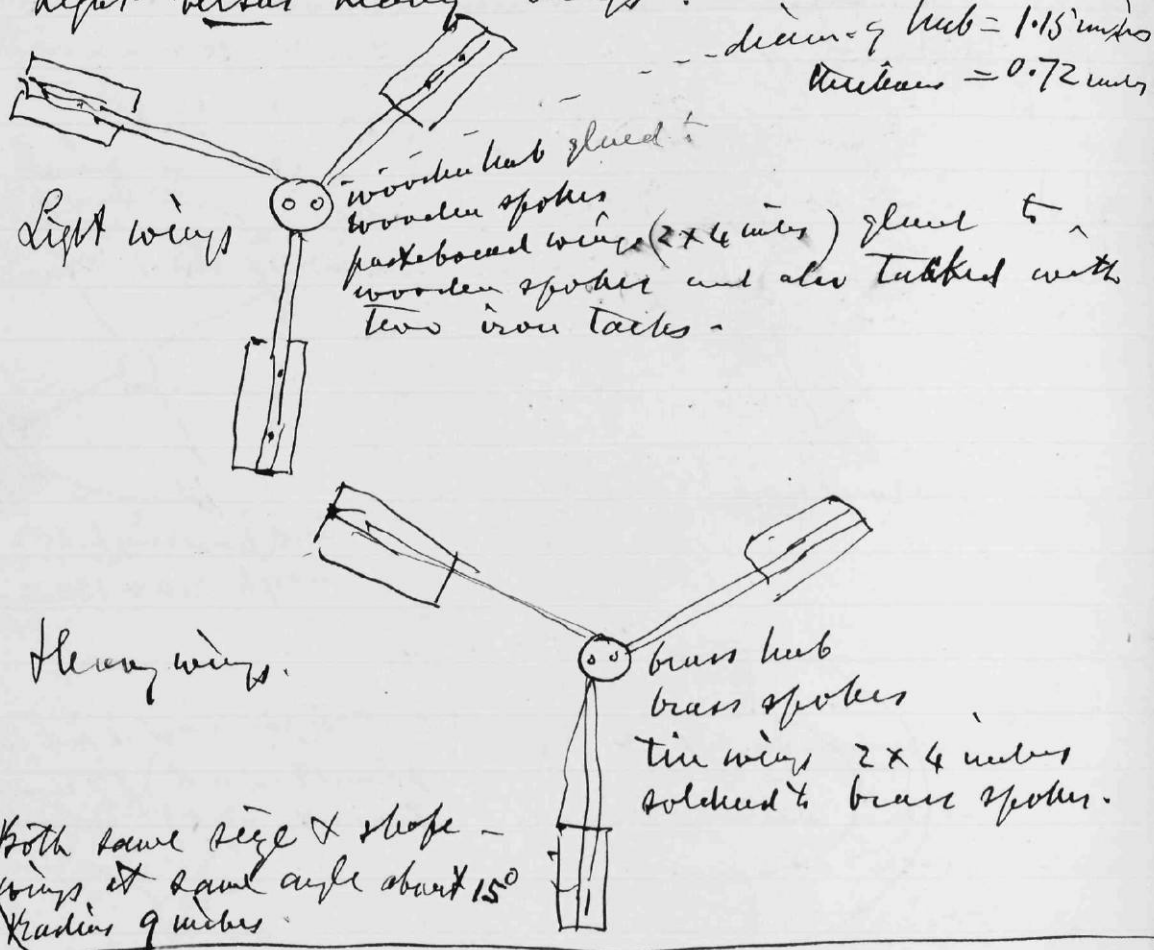


Tin strips for rings 1 inch wide.)
Diameter (a d) 17 inches
Diameter (b c) 9 inches.

weighs 319 grammes.

1893 June 5 – Revolving at BB Lab,

Exp-1. Light versus heavy wings.



R. B. June 6/93

Total wing surface = 24 sq inches
Total weight = 143 grams
24)143(6 grammes per square inch of wing surface
144

Light Heavy Wing-piece = 143 grammes.

24)35(1.4 grammes per square inch of wing-surface.
24
110
96
140

Light Wing-piece = 35 grammes
Load (brass) = 108
Total = 143

~~R. B. Heavy wings~~

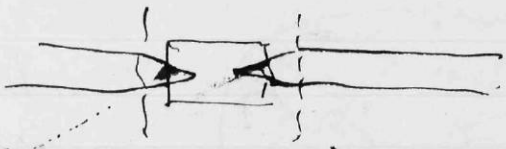
Result. Light wing piece when at angle about 20 degrees stopped rotating after about 30 to 40 revolutions. Heavy wing piece rose about 75 feet in the air & continued

1893 June 5th — Monday — at U.S. Lab.

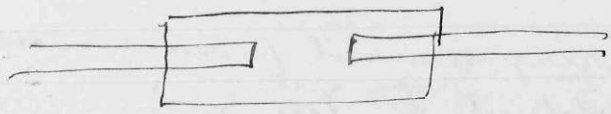
rotating for much longer time than other — sound away high in air — came down about 150 feet away.

Upon opening experiment with light wing-piece — only the wooden spokes broke so we were unable to try experiment of loading wing-piece.

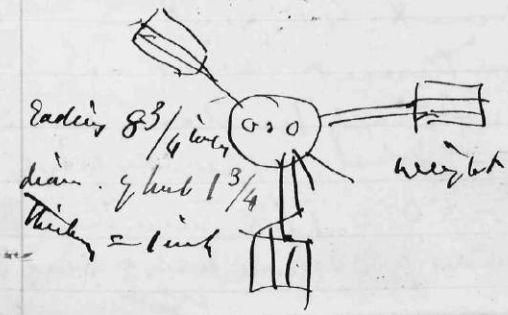
Wooden hub too small — so wooden spokes were whittled down to go into holes in hub — thus



weakening spokes just where they needed most strength. Have sawn off pointed ends of wooden spokes (see dotted line above) and W. Ellis is now making a larger hub to receive ends of spokes without whittling.



Ex. 2. Wooden wing-piece repaired.



weight 56 grammes.

Brass wing-piece
heavy w.p. = 143 grm
light = 56
load = 87

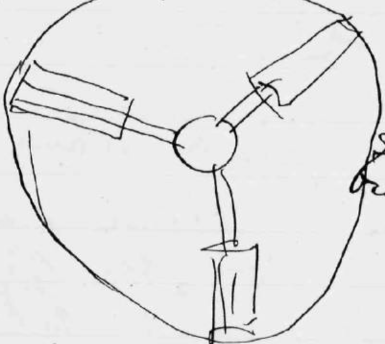
1893 June 5th — Morning — at BB-Lab.

Exp. II (continued) Light wing-piece rose 15 or 20 ft.
Heavy wing-piece rose 50 to 75 ft.
Light wing-piece loaded 5 or 6 ft.

(1) Heavy wing-piece incomparably better than light.

(2) Loading light wing-piece in center does not improve its lifting or sustaining power.

Exp. III Will now try effect of loading light wing piece on circumference — so as to get effect of centrifugal force of load in sustaining rotation.



Wing-piece = 56
Brass ring = 70
126

Apparatus as whole weighed = 130

Light wing much improved by circumferential weight. — Not improved (but reversed) by central weight.

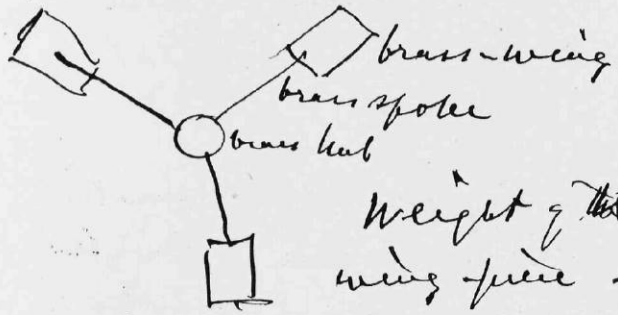
Exp. IV. Brass ring removed from wooden wing-piece — and soldered to tin-wing-piece used in Exp I p. 254.

Went up well — to a height of about 40 feet — but not so well as without ring.

The three wings alone (single tin blades each 2 x 4 inches) weigh 50 grammes. Whole apparatus weighs 215.
Dead weight or load = 215 − 50 = 165 more than three times the weight of wings. 9 grammes per square inch of wing surface, abt

1893 June 5 – Monday – at Bell Lab 25}

Exp. V – Forgot to note another experiment in which brass wings (2 x 4 inches) were used instead of tin wings. Dimensions the same as the pasteboard, & tin winged arrangements.



Weight of whole wing piece = 226 grammes.

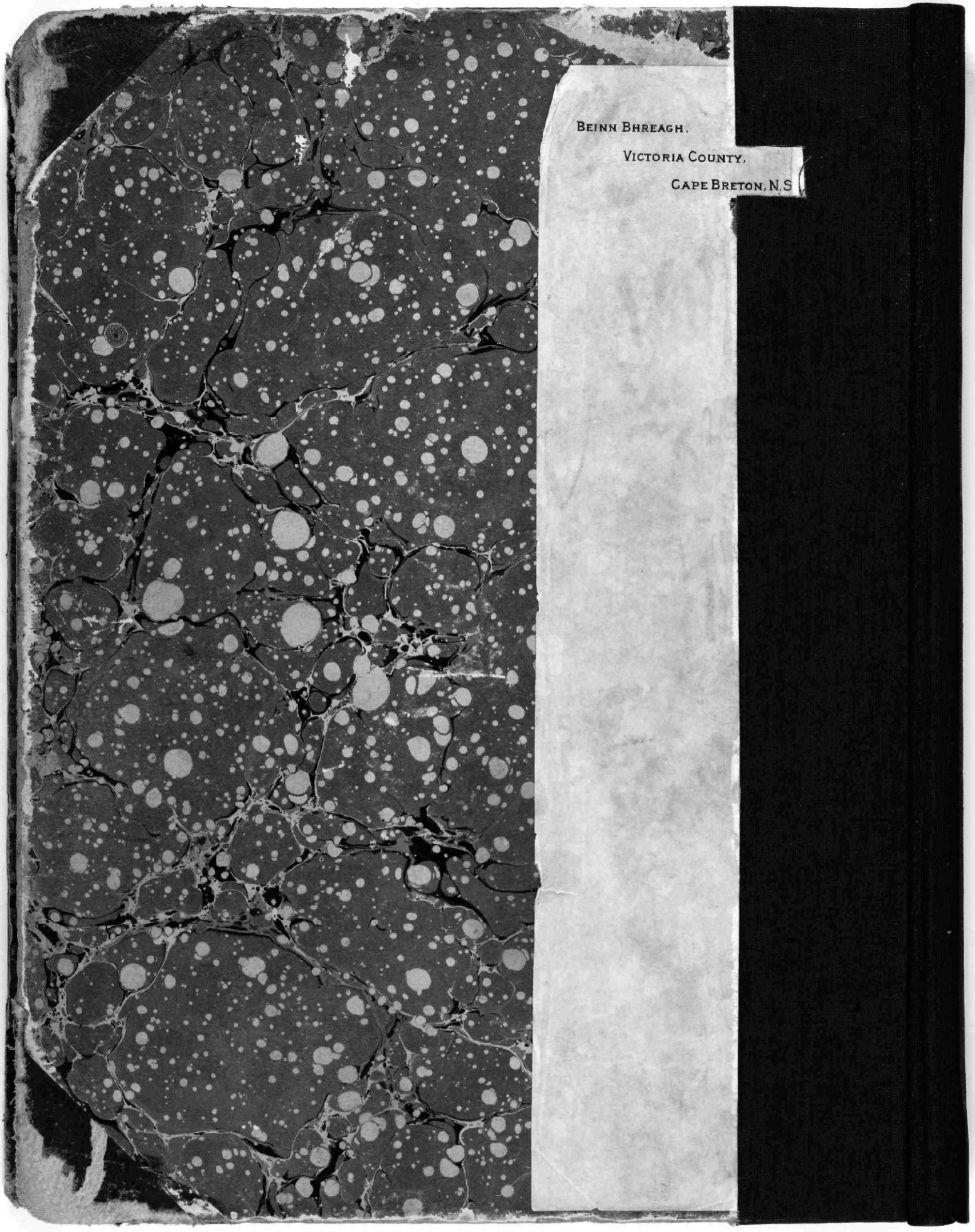
This rose well – First trial it seemed that strength of rose as high, and went farther under influence of wind than tin wings. Subsequent trials convinced us that the tin wings worked rather better.

Exp. V
Total wing surface 24 sq. inches
Total weight 226 grammes

24) 226
12) 113 (9.4 grammes to
108 every square inch
-- 50 of wing surface.

P.S. Experiment No. IV repeated some best results got obtained Apparatus went up 70 or 80 feet into the air. Witnesses – John McKellop, Angus McInnis & AGB

June 5th 1893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